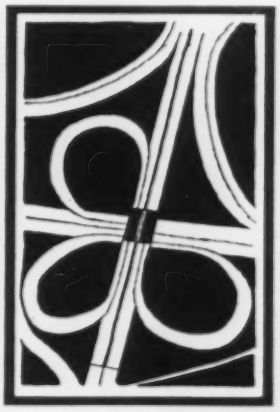
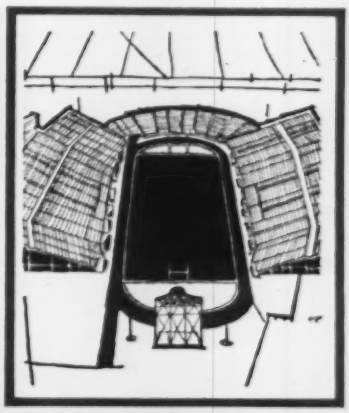
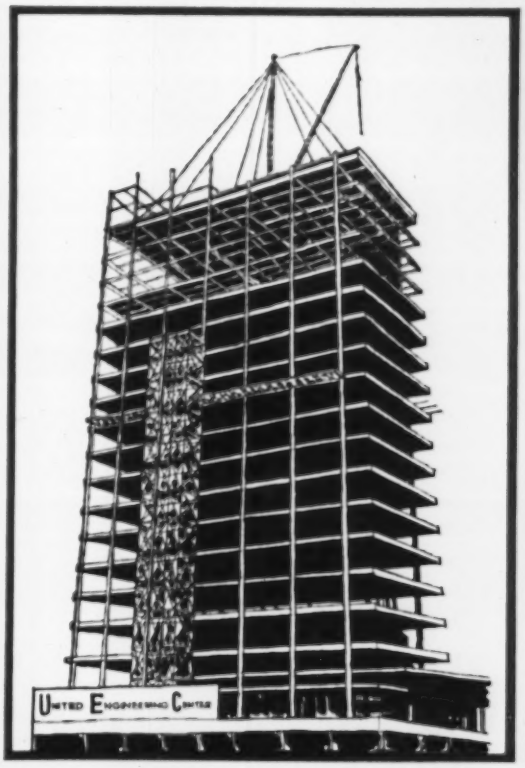
CIVIL ENGINEERING

THE MAGAZINE OF ENGINEERED CONSTRUCTION • OCTOBER 1960







AMERICAN SOCIETY OF CIVIL ENGINEERS FOUNDED 1852

30th Anniversary issue features URBAN RENEWAL

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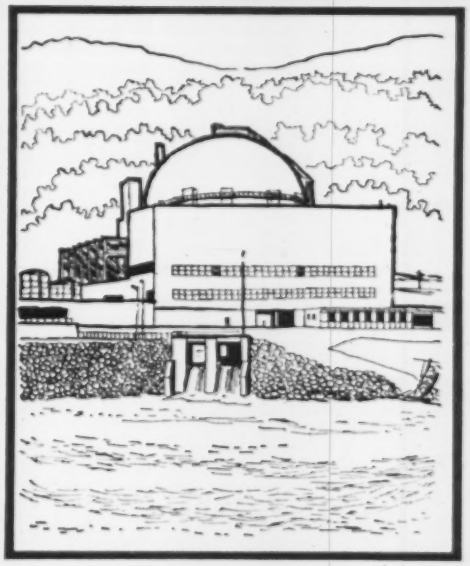

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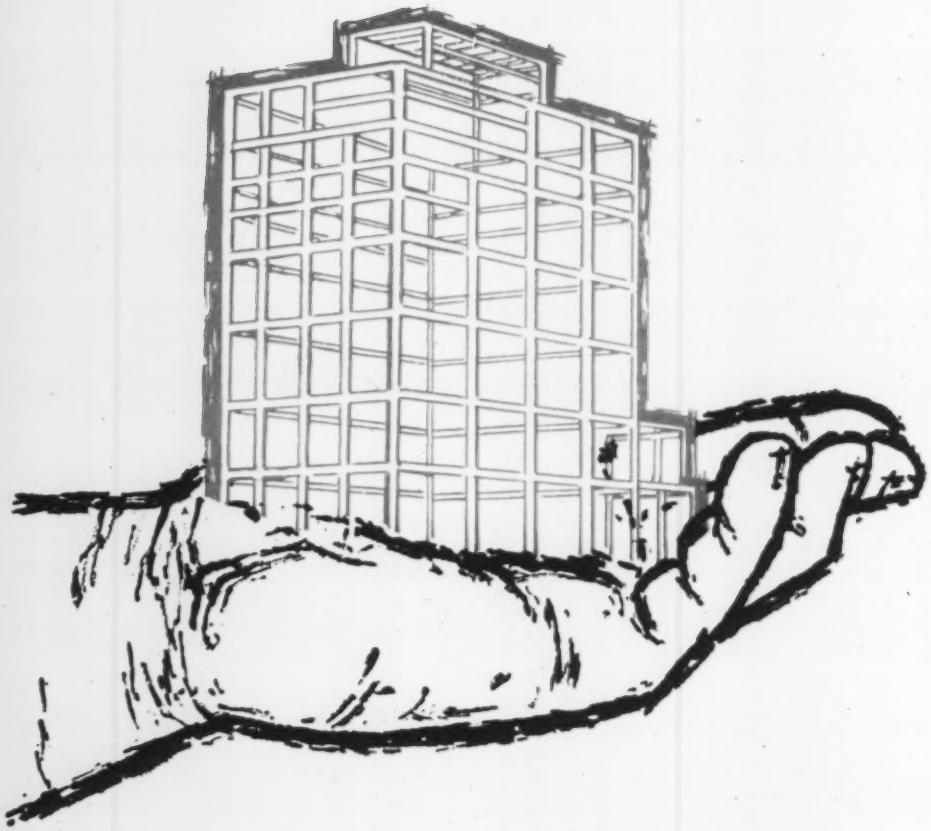

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CIVIL ENGINEERING

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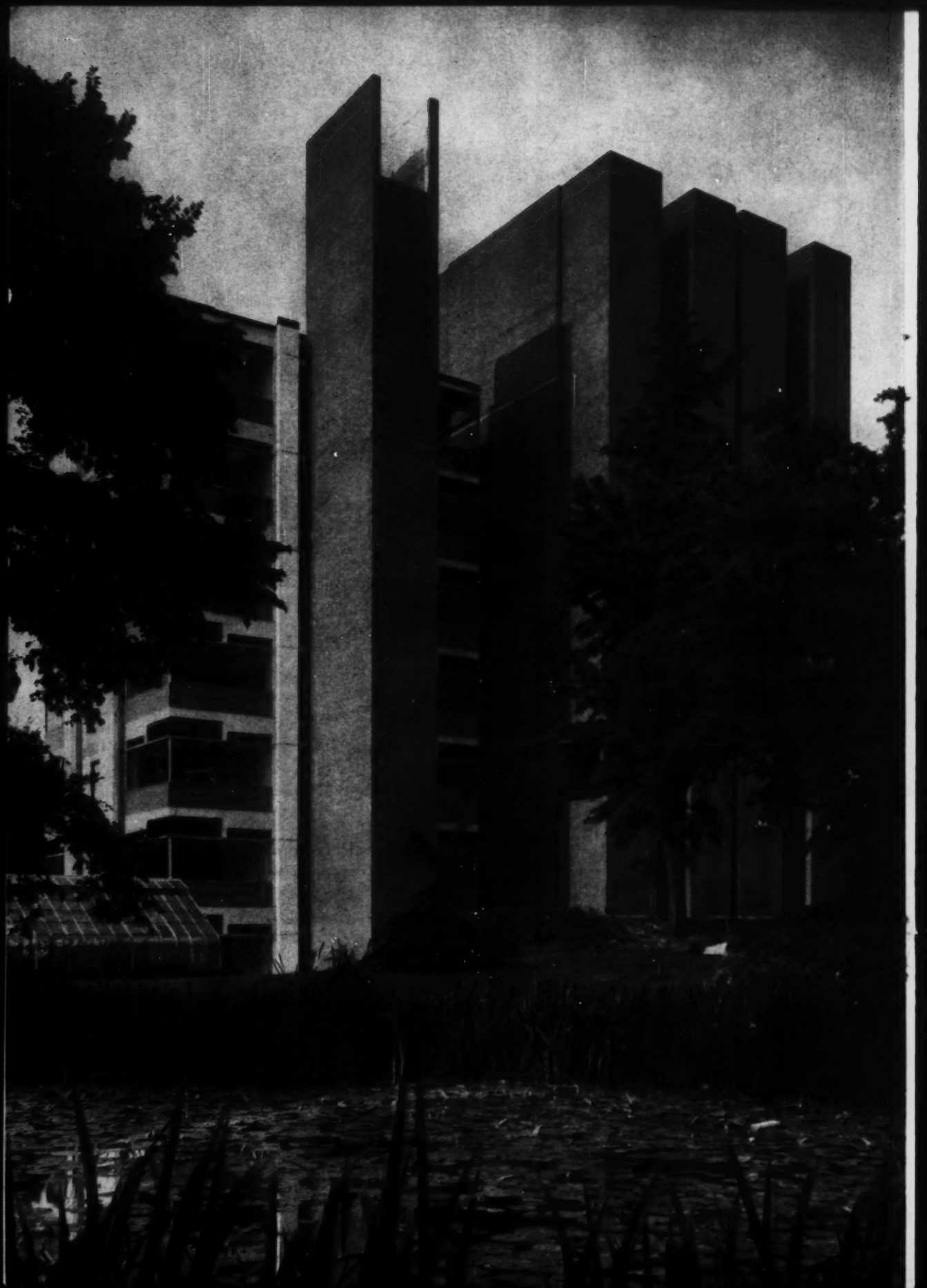


CONCRETE

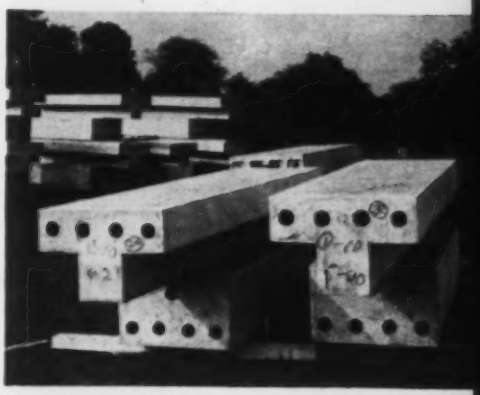
FOR KAHN'S "IVORY TOWERS"

To architect Louis Kahn, the ideal environment for a research scientist is a laboratory secluded from its necessary utility services.

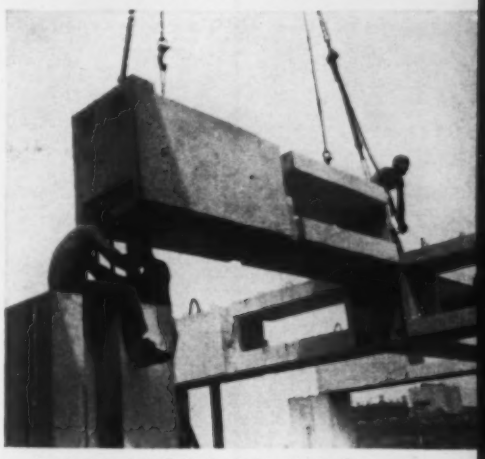
This is illustrated—uniquely—by Kahn's new medical research building at the University of Pennsylvania. Here laboratories occupy three 8-story towers. These connect at each floor with a central structure containing the mechanical equipment, elevators, and other services. Air intakes, exhausts, and fire stairs are housed in tall exterior shafts. The laboratory studios therefore provide a quiet atmosphere, free from distraction.

Concrete contributed intriguing architectural expression to this significant complex. More than 1,000 precast members were manufactured to extremely close tolerances in four specially-designed shapes. At the site, they were interlocked intricately to create the structural frames for the laboratory towers.

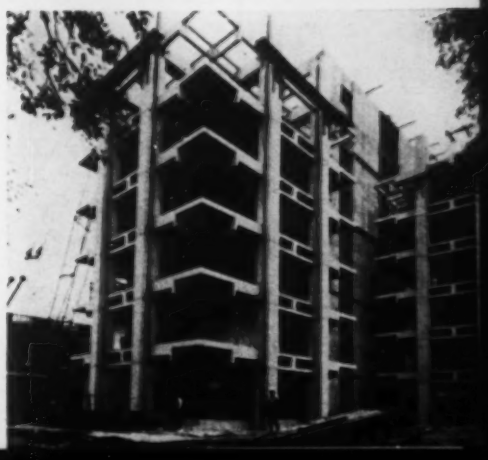
Concrete for all these precast members was made with 'Incor'®, America's first *high early strength* portland cement. By speeding the production of such precast concrete members, 'Incor' helps make them economical, helps make this unique type of construction possible.



More than a thousand precast concrete units, produced with the utmost precision and speed . . .



. . . intricately interlocked at the site to form economical multi-story structural frames.



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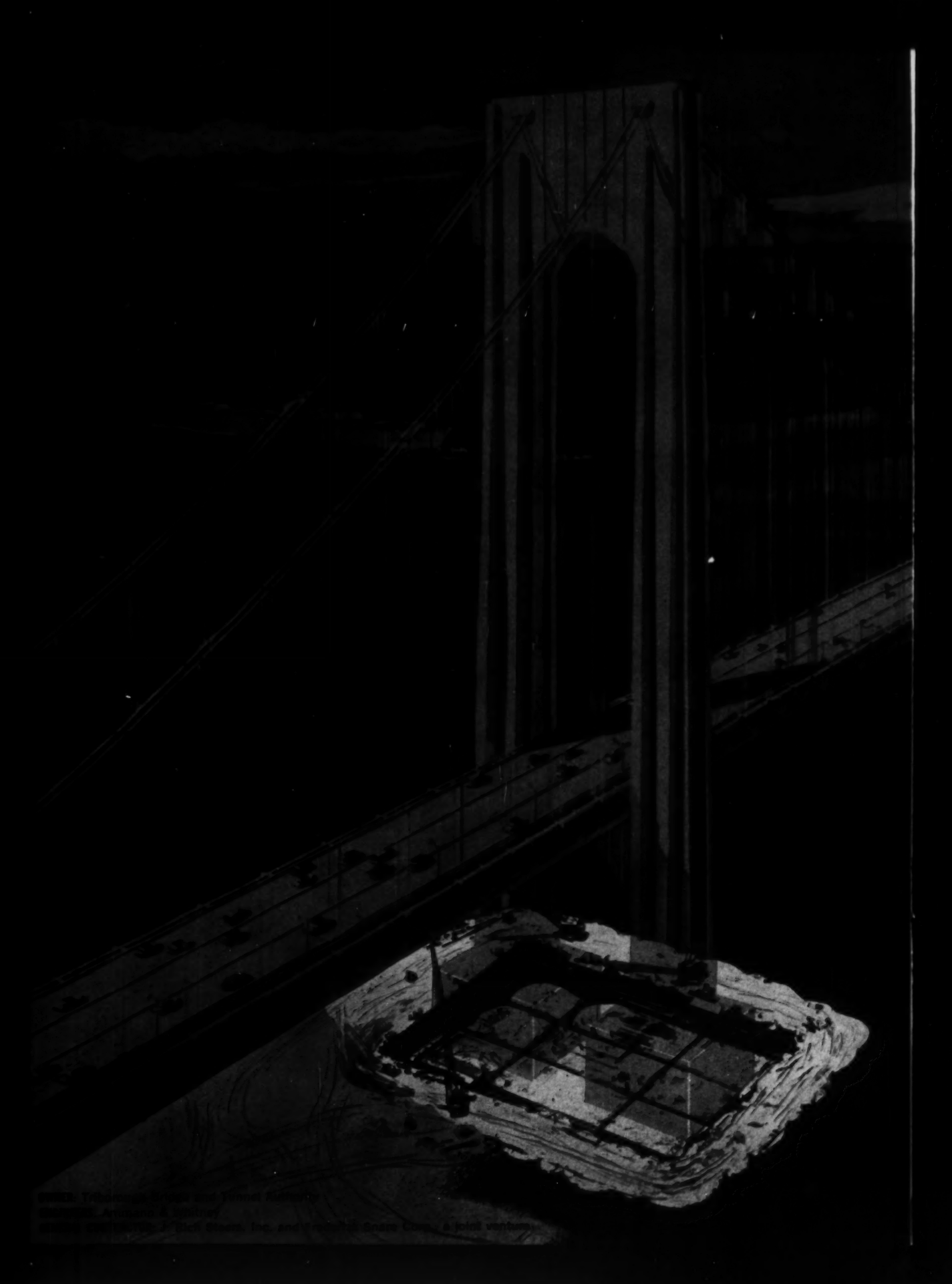

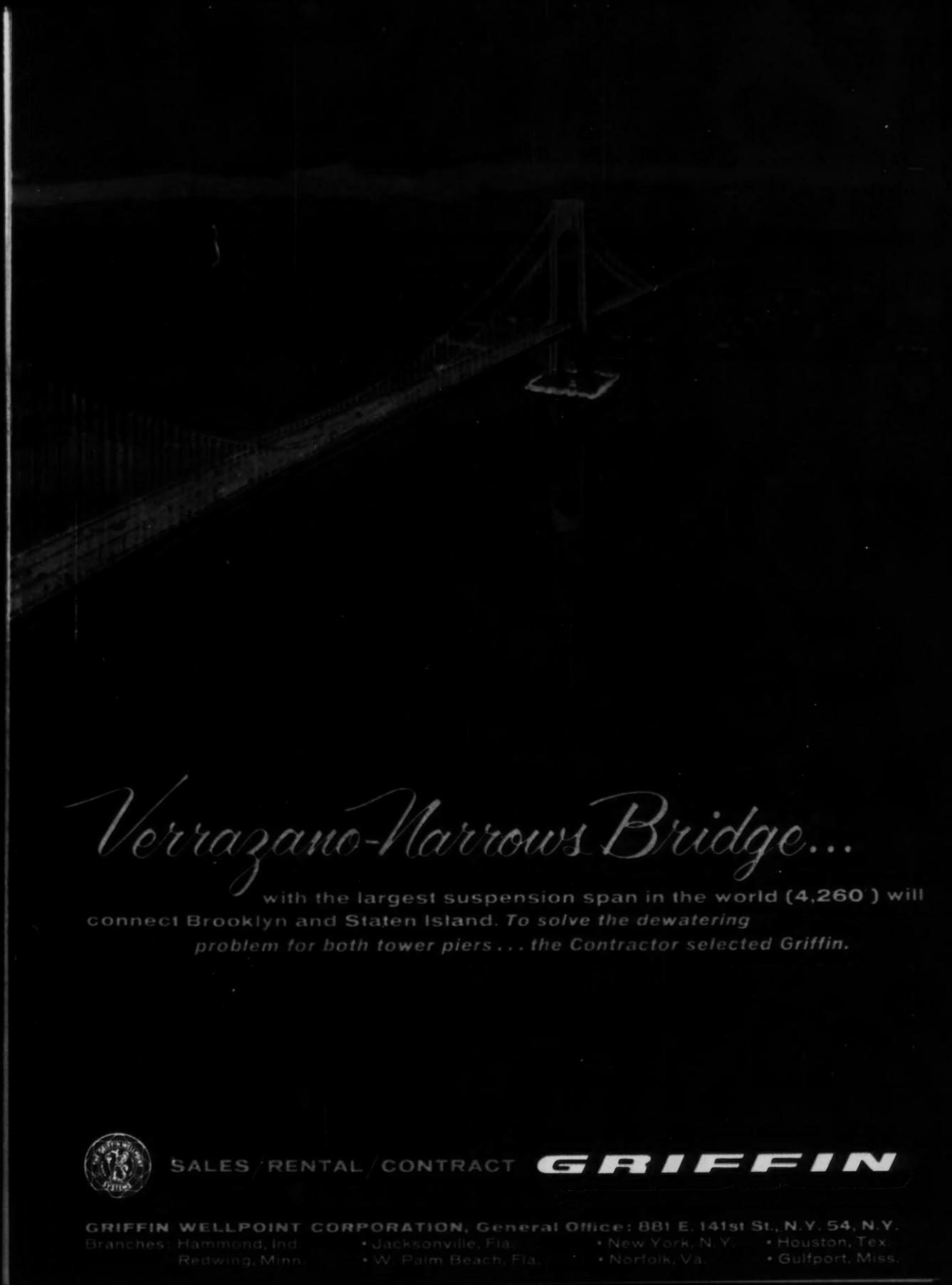

Verrazano-Narrows Bridge...

with the largest suspension span in the world (4,260') will connect Brooklyn and Staten Island. *To solve the dewatering problem for both tower piers . . . the Contractor selected Griffin.*

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. . . *Double-acting* steering jacks

. . . Positive leverage "never-over-center" linkage design

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For everything you want in big-production motor scrapers, turn to *full-power steering—double-acting bowl jacks—highest apron lift* and *forced ejection*—KON-TORK *differential* . . . good reasons why you can tackle any size job and be confident of top-notch production. When you put any Allis-Chalmers motor scraper in your spread—from 155 to 340 hp . . . 10 to 30 yd—you'll *see* the difference *on the fill.* Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

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AT FULL 90°...

...THAN OTHERS DO STRAIGHT AHEAD

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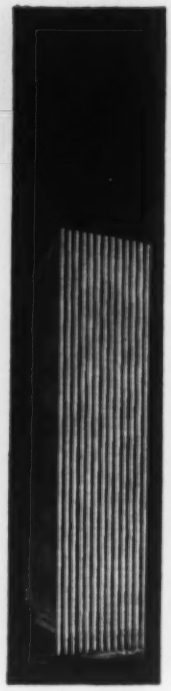


Owner: United of America Building, One East Wacker Drive, Chicago, Illinois. Architects and Engineers: Shaw Metz & Associates, Chicago, Illinois. General Contractor: A. L. Jackson Company, Chicago, Illinois. Steel Fabricator and Erector: American Bridge Division, United States Steel.

ST USE MAN-TEN (A 440) HIGH STRENGTH STEEL IN A SKYSCRAPER SAVES $45,000!

The three basement floors and the first 23 floors of the 40-story United of America Building, Chicago, which will be the Home Office of the United Insurance Company of America, will have USS MAN-TEN (A 440) High Strength Steel 14" WF columns. These will range in weight from 426 to 158 pounds per foot. The remaining columns above the 23rd floor will be structural carbon steel, ASTM A-7, 14" WF's ranging in weight from 287 to 78 pounds per foot.

When compared to a design using structural carbon steel throughout, the design using high strength steel in the columns up to the 23rd floor resulted in a weight reduction of approximately 800 tons of steel and savings of about $45,000 in the cost of the entire erected frame.

The decision to use high strength steel up to the 23rd floor only was based on consideration of deflection limitations.

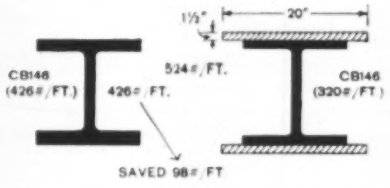
The use of USS MAN-TEN (A 440) High Strength Steel reduced the depth and weight of the columns and eliminated the need for cover plates on many of them, thus reducing fabrication costs. Architectural details were simplified and considerable space was saved around the columns.

Total steel used: 2,300 tons of USS MAN-TEN (A 440) Steel; 3,915 tons of ASTM A-7 Structural Steel; 88 tons of high strength bolts: Grand total 6,303 tons. The 2,300 tons of MAN-TEN (A 440) Steel did the job that would have required 3,100 tons of A-7 Steel. Thus, there was a weight saving of 800 tons in these columns or 25.8%. When weight savings exceed 16%, it is usually more economical to use USS MAN-TEN (A 440) High Strength Steel.

Up to ¾" thick, the minimum yield point of USS MAN-TEN (A 440) Steel is 50,000 psi . . . with somewhat lower values for thicker sections, yet still higher than structural carbon steel. It is well suited to bolted and riveted construction and has been widely used to save weight in bridges and construction equipment. For welded construction, USS TRI-TEN High Strength Steel is recommended because of its superior welding properties and equally high strength. For more information, write to United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

USS, MAN-TEN and TRI-TEN are registered trademarks

How weight was saved on first four stories.



(Left) USS MAN-TEN Steel. An interior column from 3rd basement. Simple 14" WF section (CB 146) weighing 426 pounds per foot. It was possible to omit cover plates on 50% of all columns.

(Right) If ASTM A-7 Steel had been used, 14" WF section (CB 146) weighing 320 pounds per foot would have needed reinforcement of two cover plates 20 inches wide x 1½ inches thick. Total weight 524 pounds per foot. High strength steel saved 98 pounds per foot.

USS

United States Steel Corporation – Pittsburgh
Columbia-Geneva Steel – San Francisco
Tennessee Coal & Iron – Fairfield, Alabama
United States Steel Supply–Steel Service Centers
United States Steel Export Company

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This mark tells you a product is made of modern, dependable Steel.

"He musta misunderstood
Gran'maw. She told him
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FOR WATER, SEWERAGE AND

losing no time!

Not Cousin Willie. He's used to working with Tyton® fastest, simplest, easiest to install pipe that ever snuggled into a trench.

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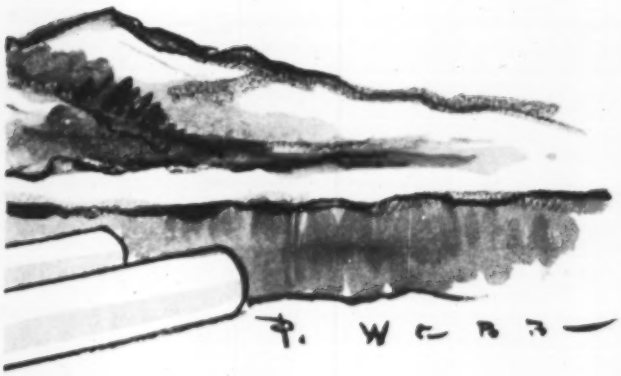
Lose no time. Get the time and money-saving facts on Tyton Joint pipe. Call or write.



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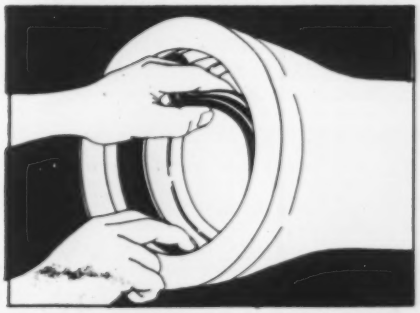
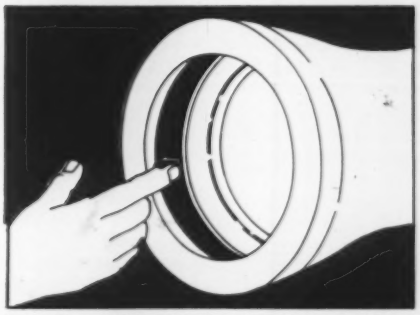
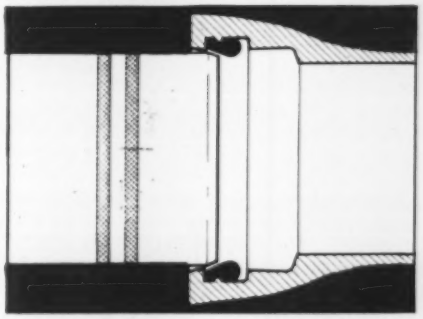


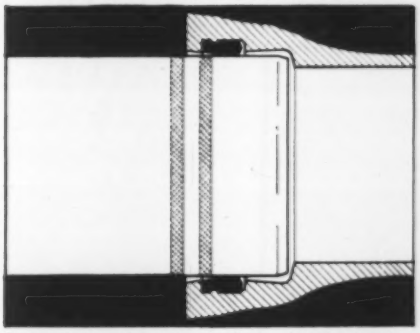
Insert gasket with groove over bead in gasket seat . . . a simple hand operation.



Wipe film of Tyton Joint® lubricant over inside of gasket. Your receiving pipe is ready.

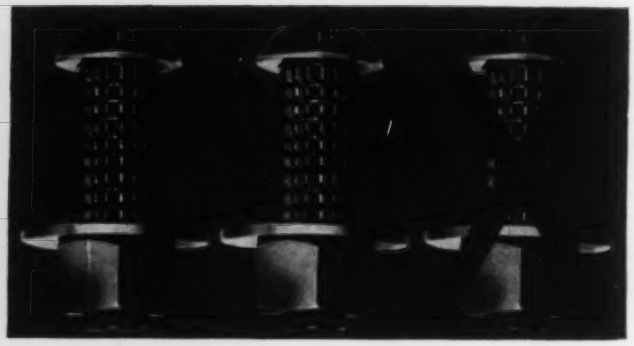


Insert plain end of entering pipe until it touches gasket. Note two painted stripes on end.



Push entering pipe until the first painted stripe disappears and the second stripe is approximately flush with bell face. The joint is sealed . . . bottle-tight, permanently! The job's done . . . . fast, efficiently, economically. Could anything be simpler?

NOW... Save The Cost Of Every 3rd Bolt



Reduce Construction Costs With Approved ANCO High Tensile Interference-Body Structural Bearing Bolts

Considerable savings can be made in erection costs if structures are designed for bearing type connections to be made with new ANCO High Tensile Interference-Body Structural Bearing Bolts. New specifications permit the use of 2 such Bolts where heretofore 3 rivets were required for the same connection. This is approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation and endorsed by the American Institute of Steel Construction and Industrial Fasteners Institute.

Now it is possible to save on total fastening time during erection . . . cut the cost of pre-fabrication . . . and reduce the number of holes at joints and still get specified total shear strength.

ANCO High Tensile Structural Bearing Bolts have this distinct advantage: They are made in increments of 1/8", permitting proper rib length for plate thickness. Such precision fitting is not possible when a bolt of a single size is used for three or four different grips. When ribs are too long, the nut will not seat properly. When ribs are too short, plates are not in full bearing. When ANCO Bolts are used, no threads are in the shear plane.

To make it easier for erectors to quickly locate proper size bolts for each connection, include a list of grips when ordering and bolts will be packed accordingly.

Use ANCO Lock Nuts When Joints Require No Torquing

When it is unnecessary or impractical to torque bearing joints, hardened washers are not needed. However, there is a need for a self-locking nut. When ANCO Self-Locking Hex Nuts are used with High Tensile Structural Bearing Bolts, extra safety is added at no extra cost. ANCO Lock Nuts are recessed on the bottom, permitting the nut to go over the ribs, insuring a proper seat against the work.

University Tests Prove Superiority Of ANCO Interrupted Rib High Tensile Bearing Bolts

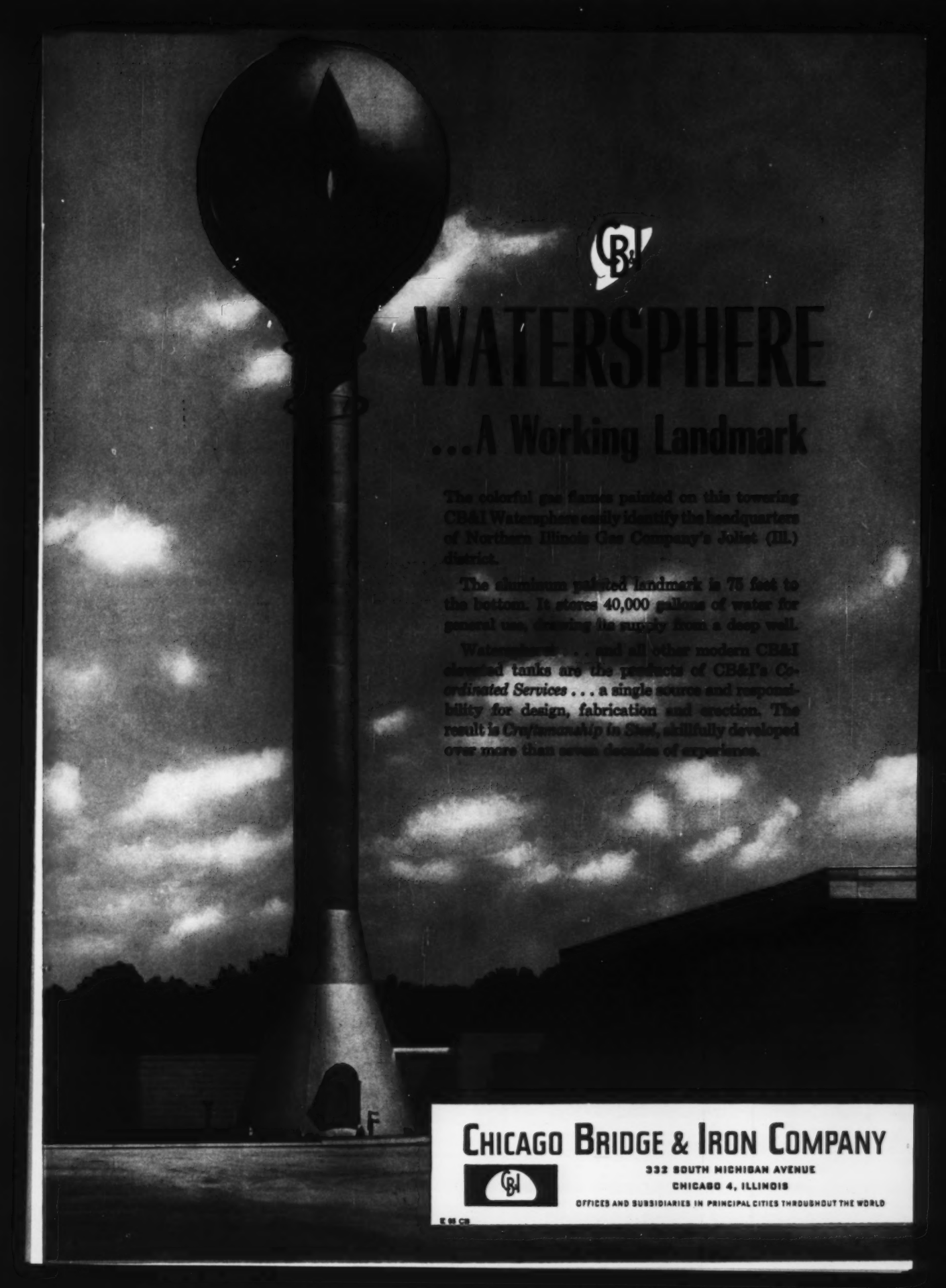
This series of tests proved conclusively that ANCO High Tensile Structural Bearing Bolts are stronger than hex head high strength bolts, as a result of the greater area of the ribbed section of the ANCO Bolt versus the shank section of the hex head bolt.

These are the results:

Bolt Size	Ultimate Load (lb.) Hex Head Bolt	Ultimate Load (lb.) ANCO Bolt
5/8"	25,560	28,390
3/4"	31,530	35,650
7/8"	41,790	51,580
1"	51,700	69,730

Please write for complete information about the results of these tests.

AUTOMATIC NUT COMPANY
INCORPORATED
LEBANON, PENNA.


WATERSPHERE
...A Working Landmark
The colorful gas flames painted on this towering CB&I Watersphere easily identify the headquarters of Northern Illinois Gas Company's Joliet (Ill.) district.
The aluminum painted landmark is 75 feet to the bottom. It stores 40,000 gallons of water for general use, drawing its supply from a deep well.
Watersphere . . . and all other modern CB&I elevated tanks are the products of CB&I's *Coordinated Services* . . . a single source and responsibility for design, fabrication and erection. The result is *Craftsmanship in Steel*, skillfully developed over more than seven decades of experience.
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LOOK WHAT THEY'RE DOING WITH DEEP STRENGTH ASPHALT PAVEMENTS IN WESTERN KANSAS!

To withstand heavy traffic, sizzling heat, numbing cold...

11-inch sand-Asphalt base is chosen for Kansas Interstate 70

Traffic will soon be rolling on a new DEEP STRENGTH Asphalt pavement section of Interstate 70 in Trego County, Western Kansas. In this part of the country, temperatures range from a numbing 20 below zero in winter, to sizzling 115°F in summer; winds sometimes reach hurricane force.

To meet the demands of expected heavy traffic and extreme weather, Kansas Highway Commission Engineers chose DEEP STRENGTH Asphalt pavement. Notice construction and cross-section (below). See how precepts of the new DEEP STRENGTH Asphalt design are incorporated . . . heavy-duty, **full width** Asphalt Concrete surface . . . **11-inch heavy-duty, sand-Asphalt base** . . . heavy compaction . . . good drainage. Here is strength and durability!

Minimum Maintenance

When built like this—for DEEP STRENGTH—Kansas experience has shown that Asphalt pavement will carry the heaviest traffic loads *without* distress and *with minimum maintenance.*

Make Best Use of Road-building Dollars

Like many other states, Kansas is finding that when Interstate highways are built with Advanced Design DEEP STRENGTH Asphalt pavements, the best use is made of road-building funds. For the Advanced Design Criteria for Asphalt pavements often save money over the cost of Asphalt pavement designed to other standards. The reason is the Advanced Design Criteria permit inexpensive Asphalt base to be substituted, within limits, for more expensive Asphalt concrete surfacing, and allow reduction in total structure thickness when used in place of untreated base.

New Handbook

A new edition of the *Asphalt Handbook* incorporating all the Advanced Design Criteria implied by the term DEEP STRENGTH Asphalt pavement is now available at the Asphalt Institute office serving your area.

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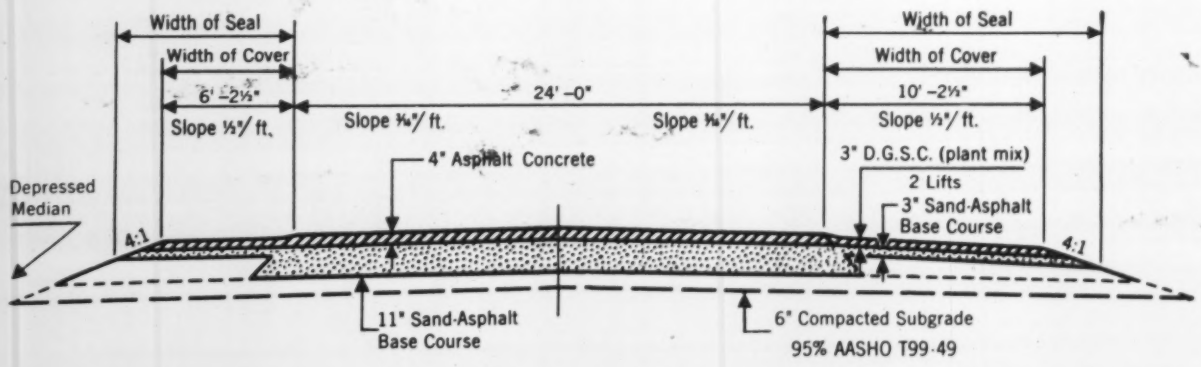
ASPHALT INSTITUTE BUILDING, COLLEGE PARK, MARYLAND

TYPICAL PAVING SECTION



Subgrade was compacted and fine graded before road-mixing of sand-Asphalt base.

Local sand shaped in windrow, bladed to reduce moisture to less than 1%, reshaped into windrow, mixed with Asphalt through traveling mixer—aerated and compacted.

Supporting courses are compacted with high contact pressure pneumatic roller to assure smoother riding under all traffic weights to come. Contractor's equipment was permitted on base course during construction of successive layers, which assisted in obtaining maximum density and reducing haul costs.

THIS IS DEEP STRENGTH CONSTRUCTION

A
2-inch surface course

B
2-inch binder course

C
11-inch
sand-Asphalt base

D
Subgrade

The Significance of
FRANKI FOUNDATIONS
at Brasilia—the Dream Capital

For Brazil, 1960 is an historic year. The seat of the national government was moved 600 miles from the old seacoast city of Rio de Janeiro to the new inland city of Brasilia.

Upon first seeing the new capital, nearly finished after only four years, visitors are variously impressed. Some are awed by the size. Spread out over a previously undeveloped area, buildings are grouped functionally and separated by open spaces to give a feeling of even greater vastness. Others are fascinated by the completeness of the planning. Besides providing for governmental activities, there are buildings for the residential, educational, religious and recreational needs of the incoming population. Apparent to all are the unusual architectural designs.

Not so visible to the eye are some engineering problems. Because of the inferior subsoil, nearly all the buildings and other structures require special foundations.

To date, more than 8,000 Franki caissons and piles have been installed at Brasilia.

For any major construction project, the extensive use of Franki foundations at Brasilia is significant for two reasons.

First, regardless of location of a project, no matter how big or small, there always are trained Franki engineers, with specialized equipment, available to handle the foundation sub-contracting. Franki affiliated companies and licensees are resident in 39 countries on six continents. They represent the largest world-wide organization of specialists who do *only foundation sub-contracting.*

Second, Franki foundations usually make possible worthwhile savings in time and money. Developed during 50 years for various types of construction throughout the world, over 3 million Franki units have been installed in 53 countries.

In reality, a pressure-injected footing, the distinctive Franki displacement caisson solves numerous construction problems. Each has the unusually high unit load carrying capacity of 120 tons or more.

For the United States, the main office of the Franki Foundation Company at New York is ready to serve consulting engineers and general contractors in a dual capacity—as a sub-contractor on foundations in the United States or as a contact with other Franki organizations elsewhere in the world. Write or phone.

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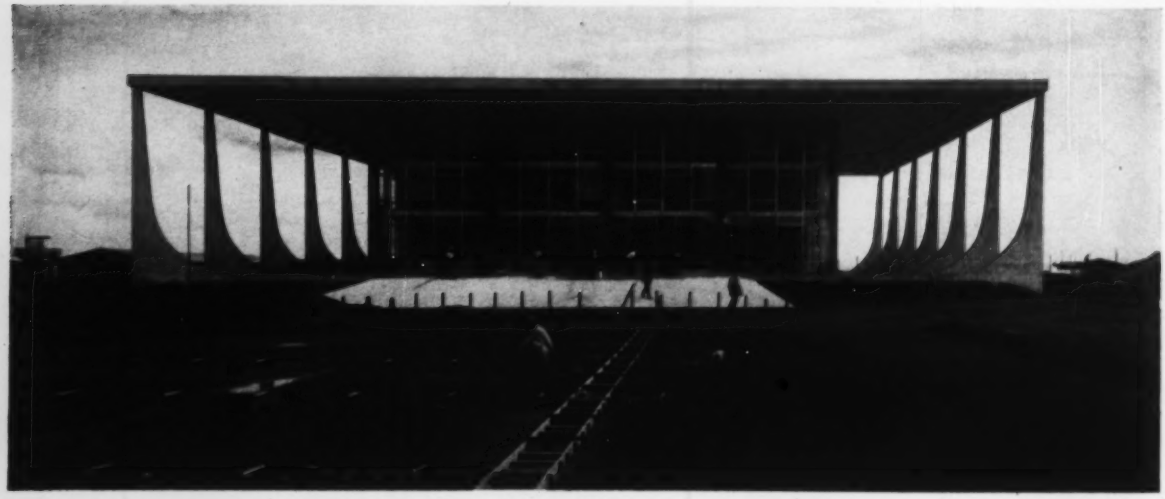

OVER 8,000 FRANKI UNITS ALREADY SUPPORT BUILDINGS AT NEW AND MODERNISTIC CITY

Name of Structure	Piles and Caissons	Name of Structure	Piles and Caissons
Cathedral	112	Telephone Exchange	35
Palace of Congress (The Legislative Branch)	435	Barracks	192
Palace of the Government (The Executive Branch)	441	Meteorological Observatory	30
Supreme Court (The Judicial Branch)	172	Television Tower	49
Ministries and adjacent garages	512	National Press	175
Several Residential Blocks	1689	Audit Office	104
Palace-Hotel (Annex)	564	Cinema	91
Hotel National	358	Water Tank	456
District Hospital	573	Several Bridges, viaducts, overpasses, etc.	1010
Medical Assistance	83	Various Buildings (restaurants, clubs, banks, etc.)	509
Schools	395		
Covered Market	181		8166

The above Franki foundations were installed by Estacas Franki Limitada, with headquarters in Rio de Janeiro, Brazil.

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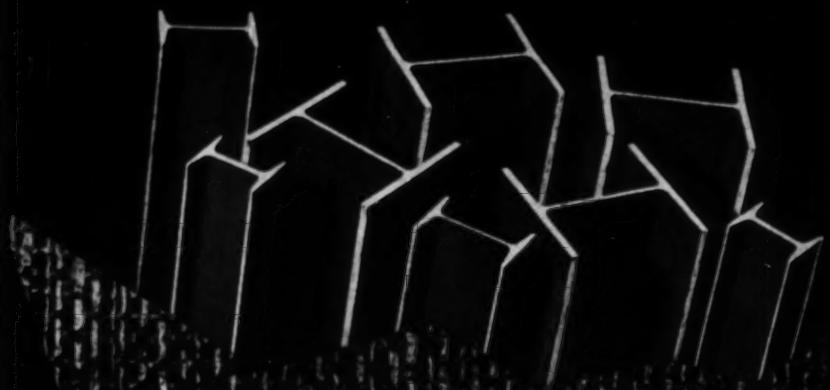

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No guesswork! Structural steel is stable, uniform. You can calculate its ability to support loads precisely, and in advance.

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You always know exactly what you're getting.

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BETHLEHEM STEEL

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...marketed by Royal McBee Corporation

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The RPC-4000 is a product of the Royal Precision Corporation, and is marketed by the Data Processing Division of Royal McBee. It is the latest member of the growing family of electronic computers from the people whose LGP-30 has become the world's leading small-scale computer.

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Royal Precision is jointly owned by the Royal McBee and General Precision Equipment Corporations. RPC-4000 sales and service are available coast-to-coast, in Canada and abroad through Royal McBee Data Processing offices. For full specifications, write **ROYAL McBEE CORPORATION,** data processing division, Port Chester, N.Y.

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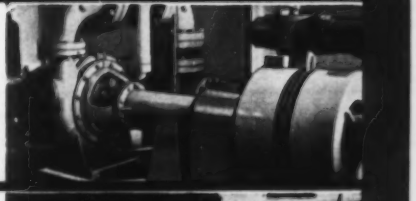

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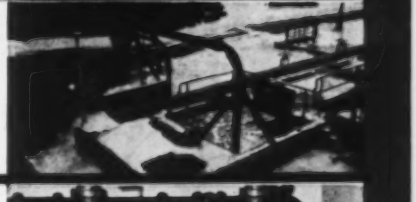

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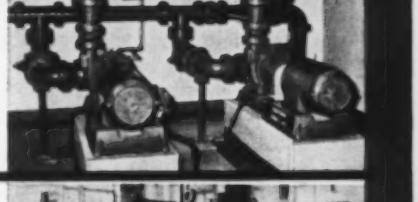

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NEWS OF MEMBERS

George T. Treadwell for the past 15 years chief engineer for the Port of Seattle, Wash., has left to join the engineering and architectural firm of Tippetts - Abbett - McCarthy - Stratton where he will serve as Pacific Northwest manager, with headquarters in Seattle. As chief engineer for the Port, he supervised the design and construction of the Seattle-Tacoma International Airport, the 700-boat terminal for the commercial fishing fleet at Salmon Bay, the 1,600-boat Shilshole Bay Marina now under construction, and numerous other waterfront projects.

George A. Reznicek is resigning after 26 years as treasurer and chief engineer of the William L. Crow Construction Company of New York City to become superintendent of public works, planning and industrial development for Morris County, New Jersey. During the 1951-1958 period Mr. Reznicek was on special assignments in connection with the firm's overseas work.

R. M. Mains, one of the original three engineers on the U.S. Guided Missile Program, will work in applied mechanics on structural dynamics problems as the new structures engineer in the mechanical engineering component of General Electric, Schenectady, N. Y. Prior to joining GE at the Knolls Atomic Laboratory in 1955, Dr. Mains was project supervisor in the applied physics laboratory at John Hopkins University and engineer of tests and assistant director in the Fritz Engineering Laboratory at Lehigh University.

A. D. Griffin, recently retired as assistant district engineer and executive assistant to the assistant California state highway engineer, terminating a career with the California Division of Highways that began in 1915. Combining the talents of engineer and journalist, Mr. Griffin through the years has written innumerable articles for trade and technical journals, newspapers and pamphlets. His retirement will afford him time to continue his current researches into safe driving, plus do some free-lancing.

Emerson S. Ellett, since 1949 in the contracting business in Denver where he has specialized in heavy construction, pipeline work, canal construction, and highway work, has been appointed deputy manager of public works. In his new job he will supervise many phases of Denver's work program, including major expansion of Stapleton Field.

Nikhileswar Sanyal, until recently deputy chief engineer of the Delhi Municipal Corporation of India, is now senior civil engineer for public health at the Barauni Refinery Project at Bihar, India.

S. M. Lipton, Colonel, Corps of Engineers, has assumed new duties as deputy division engineer of the North Pacific Division at Portland, Ore. His most recent assignment was with the General Staff at the Defense Atomic Support Agency at Sandia Base, Albuquerque, N. Mex., where he was deputy chief of staff of engineering and supply at the Field Command Headquarters of the atomic agency.

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Figure B-175. Type M-R Gates designed especially for application to centrifugal pump discharge lines. A rubber seating ring is inserted in the seat to absorb the slap which occurs when pumps stop. A flexible bar connection is arranged between the hinge links to provide a stop for the gate shutter to prevent the outer edge of the shutter from tipping downwardly when flow abruptly ceases. Smaller sizes of gate are provided with a bumper arrangement to prevent the shutter being forced too widely open when flow starts.

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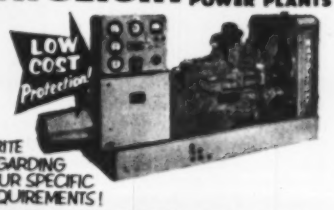

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Box 891-20 Mankato, Minnesota

Kenneth B. Young, formerly chief of the planning section in the Water Resources Division of the U. S. Geological Survey, Washington, D. C., has been appointed to the Survey's Branch of Surface Water, Madison, Wis., as district engineer. Mr. Young worked on water resources investigations in Maine for the Survey prior to transferring to its Washington office about ten years ago.

William H. Giles, a veteran of 46 years' service with the Missouri Pacific Railroad, retired recently as assistant chief engineer. In the 1950's Mr. Giles had major responsibility for the design and construction of the railroad's $13,000,000 freight car classification yard at Kansas City.

Frederick W. Crane has been elected president of the American Public Works Association. Currently general manager of the Buffalo (N. Y.) Sewer Authority, he has divided his time since 1923 between the Sewer Authority and the Public Works Department, which he served from 1950 to 1953 as commissioner. Mr. Crane holds many awards for his accomplishments in advancing knowledge in the field of sewage and industrial wastes.

Douglas C. Atkins has joined the engineering department of the Monsanto Chemical Company's Organic Chemicals Division in St. Louis. Mr. Atkins has been serving as a civil engineer with the Corps of Engineers at Fort Riley, Kans.

Martin H. Blote, retired recently as supervisor of irrigation and power for Region 2 of the U.S. Bureau of Reclamation after 16 years of service. Earlier he worked for the California State Department of Water Resources (then known as the State Engineer's Office) for more than 20 years. During part of that period he participated in the original studies that led to the construction of the Central Valley Project.

Norman C. Emerick announces the opening of a new office for his consulting civil and structural engineering practice at 1011 North Calvert Street, Baltimore, Md. Until recently he was bridge engineer with the Baltimore firm of Joseph K. Knoerle Associates, Inc.

J. Morley English is the newly-appointed vice chairman of the University of California of Los Angeles Department of Engineering in charge of the Institute of Industrial Cooperation, which coordinates engineering research at the University. Dr. English, who joined the UCLA faculty in 1952, was named Fulbright Professor at Roberts College, Turkey, in 1957. Recently he designed the "Jetway" loading ramp, which is being installed in the major jet air terminals throughout the world.

(Continued on page 26)

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In 7 "color-coded" precision line widths: 00, 0, 1, 2, 2½, 3, 4. Uses India (or regular) ink for ruling, lettering, tracing or writing with equal facility.

MODEL NO. 3065: A new model with 7 interchangeable drawing point sections, each color-coded to indicate a different line width. Best buy for the professional who requires frequent change of line widths. Each drawing point section complete with airtight refillable ink cartridge. Interchange is accomplished quickly, cleanly. Comes in handy desk top container.

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Non-slip, turn-proof clutch takes full range of Koh-I-Noor lead.
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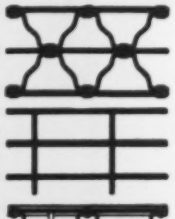

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Frank M. Albrecht, Major General, and South Atlantic division engineer for the Corps of Engineers at Atlanta, since July 1957, has retired from the Army. At a review and reception for him at Fort McPherson, he was awarded a second Oak Leaf Cluster to his Legion of Merit for outstanding service performed from 1951 to 1960. Prior to his assignment at Atlanta, General Albrecht was engineer, U. S. Army, Europe, at Heidelberg, Germany, and director of plans and programs for logistics, on the Army General Staff, Washington, D. C.

F. C. Warrington, a 23-year employee of the Pittsburgh-Des Moines Steel Company, was recently made manager of steel plate sales for the firm's Midwest Division. This division covers the midwestern states from North Dakota and Minnesota to Texas and Louisiana.

William F. Rooney, for the past six years manager of the Northwestern regional office of Ebasco Services Inc., at Portland, Ore., is moving to the firm's New York headquarters where he will be director of business development for the Management Consulting Division. From 1950 to 1953 he served Ebasco as a sales and marketing consultant.

Alfred B. Anderson has been appointed to the New Jersey State Board of Professional Engineers and Land Surveyors for a five-year term. A partner in Alfred B. Anderson Associates, Hanover, N. J., he is a specialist in water works, sewerage, sewage treatment and industrial waste treatment.

Franklin T. Matthias, as the newly appointed manager of heavy construction for Kaiser Engineers, has responsibility for all of the company's heavy construction activities in the United States and Canada. Before joining Kaiser Engineers, Mr. Matthias was chief engineer and director of engineering and construction of the Aluminum Company of Canada, Ltd. One of his significant achievements was his work as officer-in-charge of construction and commanding officer of the Hanford Engineering Works for the Manhattan Engineer District during World War II.

James E. Goddard is retiring after 32 years' active and reserve service in the Army. Colonel Goddard, as Commanding Officer of the 316th Logistical Command reserve unit for the past eight years, has had responsibility for the unit's underwater charting and mapping. Colonel Goddard is chief of local flood relations for the Tennessee Valley Authority at Knoxville.

Arsham Amirikian, special structures consultant to the Navy Bureau of Yards and Docks, has just returned from a European trip where, as a U.S. delegate, he attended two international meetings: the Annual Assembly of the International Institute of Welding in Liege, Belgium, and the Third International Congress of Precast Concrete Industry in Stockholm, Sweden. Before the meetings, he went to Austria and received the degree of Doctor of Technical Sciences from the Technical Institute (Technische Hochschule) of Vienna.

Robert Lee Casten, who joined the Granco Steel Products Company last year, has been promoted to district sales engineer in the company's San Francisco office. Earlier he was an engineer with the Laclede Steel Company.

C. O. Schofield, in recent years municipal engineer for Princeton, N. J., and municipal engineer and director of public works for the Township of Bridgewater, at Somerville, N. J., on September 19 became a staff-member of the Development Loan Fund. Although his headquarters will be in the District of Columbia, Mr. Schofield's new position will require frequent trips to foreign countries, as the fund provides capital for the economic growth of less developed free countries. Foreign travel, however, is old hat to Mr. Schofield who spent two years, 1954-1956, with AESB (Architects Engineers, Spanish Bases) as project engineer for an air base in Spain and on other foreign work.

Raymond Lamoreaux, until recently a Captain in the Navy Civil Engineer Corps, is currently director of designs and inspection in the West Palm Beach (Fla.) city engineer's office. Eventually he will take over as city engineer. During 23 years of service with the Navy, Captain Lamoreaux supervised the planning, design, and construction for stateside and overseas facilities, including the Naval Air Missile Test Center at Point Mugu, Calif.

Noah E. Hull has been elected president of the National Society of Professional Engineers. Currently, vice president and general manager of the Hughes Gun Company and assistant to the vice president, manufacturing, of the Hughes Tool Company, Mr. Hull in the past has held executive engineering positions with the General Motors Corporation, the Firth Carpet Company, and the National Gypsum Company. Vice presidents elected for a second term are **W. Earl Christian,** chief engineer of the Hefler-Snyder Company, Plainfield, N. J., and **Brandon H. Backlund,** president and treasurer of B. H. Backlund & Associates, Inc., of Omaha, Nebr. **John H. Stufflebean,** chief engineer of Blanton & Cole, Tucson, Ariz., was elected vice president for a first term.

Edmund T. Roetman and **Jack R. Davis,** newly-appointed civil engineers in the southeastern regional office of the U. S. Public Health Service, in addition to providing engineering services to the Water Supply and Pollution Control Program for developing the water resources of the six southeastern states, will assist the U. S. Study Commission in planning the development of the land

and water resources on eight southeastern river basins. Mr. Roetman for the past ten years has been with the Service's regional offices in Chicago and Dallas, while Mr. Davis, a recent graduate of Southern Methodist University, has been on the USPHS staff for five months.

Raymond E. Hess, associate executive secretary of the American Society for Testing Materials, was recently named acting executive secretary by the Board. Mr. Hess, who will continue his responsibilities as technical secretary and editor-in-chief, became associate executive secretary in 1952, after 32 years' service to ASTM.

William A. Milek, Jr., and **Samuel H. Clark,** of the American Institute of Steel Construction, Inc., have been named, respectively, research engineer on the Technical Research Program and assistant chief engineer (a new post). In the past Mr. Milek served the Institute as district engineer in Omaha, Nebr., while Mr. Clark held the same position in San Francisco.

Lester D. Lee, president of Hitchcock & Estabrook, Inc., Minneapolis, Minn., will also be available for consulting work at 46 Venetian Way, Miami, Fla., and will divide his time between Minneapolis and Miami.

James W. Dunham, former division engineer of the Division of Small Craft Harbors for the State of California, is a new addition to the marine engineering staff of Moffatt & Nichol, Long Beach, Calif. Mr. Dunham's career includes 24 years of service with the Army Corps of Engineers and several years as an engineering consultant, two of which he spent in Karachi, Pakistan, where he worked with the Ralph M. Parsons Company and the International Cooperation Administration.

Benjamin I. Stegall, after more than 30 years' service in highway engineering and transportation, has retired as planning and research engineer in the Southeastern Office of the U. S. Bureau of Public Roads. Mr. Stegall, who has served the Bureau in various capacities, was active in providing data used in developing the expressway system in Atlanta and other southeastern cities.

Junius T. Moore has been elected to the 30-member board of trustees of Bethany College. A practicing structural engineer with offices in Charleston, W. Va., Mr. Moore has been active in the professional and educational aspects of engineering since graduation from Virginia Polytechnic Institute in 1917. He is president of two Charleston companies —Fireproof Products and Industrial Engineers.

Edward Wardell, in his new position as assistant to the director of the Operations Services Department of the Port of New York Authority, will coordinate departmental administrative functions, including the development of plans for maintenance programs. Since joining the Port Authority in 1954 as a traffic engineer, Mr. Wardell has planned and designed motor vehicle routes to connect Port Authority facilities with access roads and highways.

Helmer A. Holmstrom, as the new assistant division engineer of the Army's South Pacific Engineer Division, will assist in the general management of the Division's $200,000,000 military and civil works construction programs in Arizona, California, Nevada, and Utah. Colonel Holmstrom goes to San Francisco from Fort Bragg, N. C., where he was assistant chief of staff, G-4, of the XVIII Airborne Corps and Headquarters, Strategic Army Corps.

Holbert W. Fear is retiring after more than 26 years service in the U.S. Geological Survey, the last 11 years as assistant district engineer in the Surface Water Branch of the Water Resources Division in Albany, N. Y. However, he will continue his activities as technical adviser and chairman of the Subcommittee on Hydrologic Problems for the Temporary New York State Commission on Water Resources Planning.

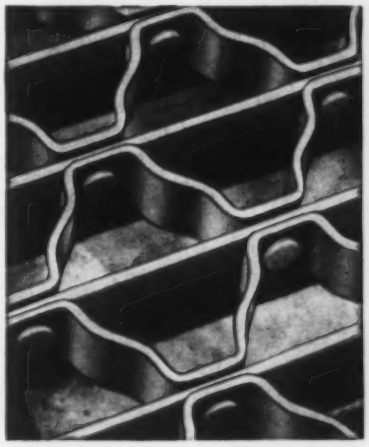
H. H. Roberts of Lakewood, Ohio, and **M. H. Slocum** of Alhambra, Calif., have formed the partnership of Slocum & Roberts, with offices in both cities. The firm will engage in heavy construction project investigations, planning, estimating and bidding, and plant layout and management.

William P. Jones, Jr., Colonel, Corps of Engineers, a recent graduate of the Army War College, has been assigned as engineer, Headquarters, Fourth Army, Fort Sam Houston, Tex. Prior to entering the War College in 1959, Colonel Jones was district engineer at Memphis, Tenn., for two years. He has been in the Corps of Engineers since 1937.

Edgar H. Hendler has left Louis Berger and Associates, of Orange, N. J., where he was senior structural designer to become a structural engineer with the George M. Ewing Company, Philadelphia architects and engineers. He has also served with the American Bridge Division of the U. S. Steel Corporation at its New York office and Elmira (N. Y.) plant.

Lester W. Bartsch, since 1931 associated with the U.S. Bureau of Reclamation, first in the chief engineer's office in Denver, Colo., and for the past nine years as assistant regional director at Billings, Mont., has joined the staff of the World Bank in Washington, D. C. As engineer in the Technical Operations Department of the World Bank, he will be concerned with its international activities in the public utilities field.

New "CK" BRIDGE DECKING ENDS WEAVING OF CARS



Modification of the original Irving Type V Decking has eliminated "weaving" on open mesh steel floors. The improvement is effected by a 7/16" elevation difference of the crimped bars over the straight bars.

"CK" Decking, successfully field-tested for 4 years, has the same advantages of safety, strength, durability and self-maintenance as standard Type V Decking

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Artist's drawing shows ASBESTOS-BONDED in cross section.

Steel

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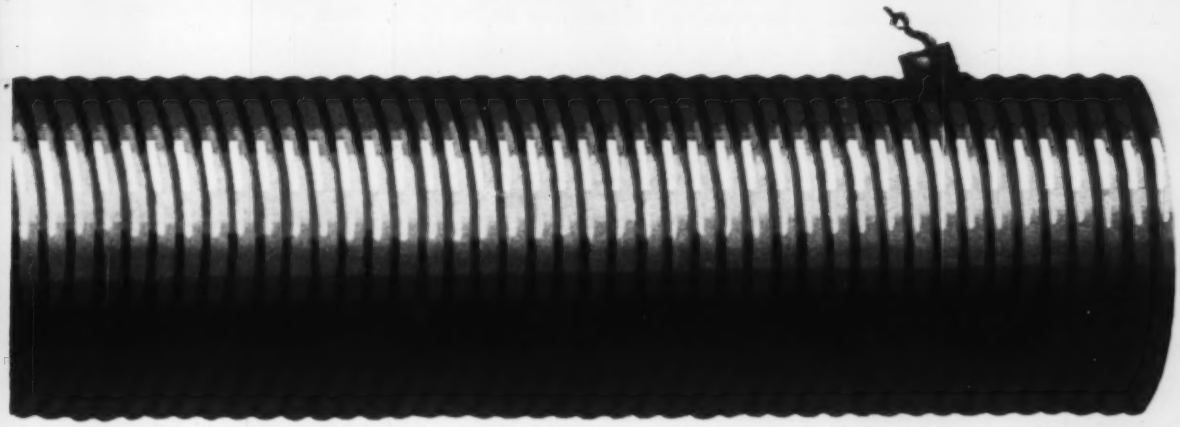

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ARMCO DRAINAGE & METAL PRODUCTS, INC.
Department G
7400 Curtis Street, Middletown, Ohio

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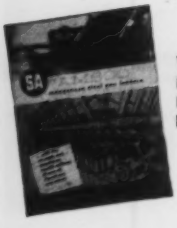

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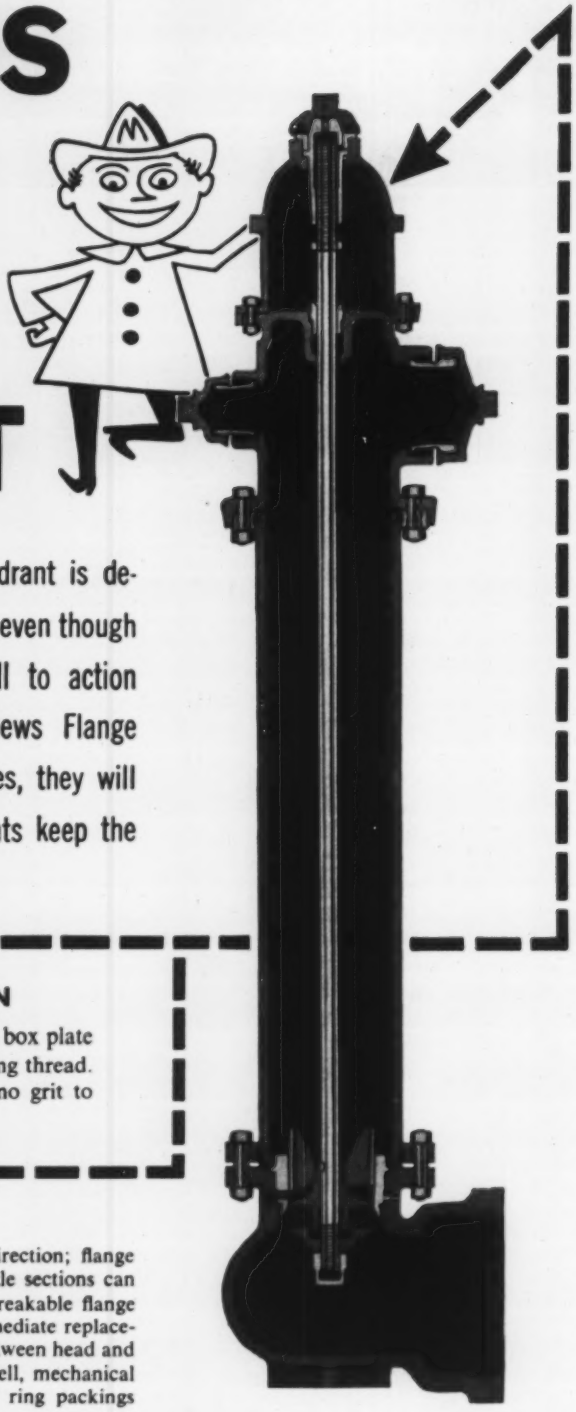
Arch bridge over north fork of Payette River, State Highway 15, Smiths Ferry, Idaho
Designers: Idaho Department of Highways, Boise, Idaho
Contractor: C. F. Dinsmore

"T" girder highway overpass, Interstate Highway 80, Low, Utah
Designers & Engineers: Ken R. White Consulting Engineers, Denver, Colorado
Contractor: M. Morrin & Son Co., Ogden, Utah

Box girder railroad overpass, Interstate Highway 15, south of Las Vegas, Nevada
Designers: State of Nevada Department of Highways, Carson City, Nevada
Contractors: Whiting Bros. Construction Co., Industrial Construction Co., and General Contractors

14-6

MATHEWS FLANGE BARREL HYDRANT



The most important single feature of any hydrant is dependability. It must be operable when needed, even though it has remained idle for years and the call to action comes during a hard freeze. Install Mathews Flange Barrel Hydrants, and when emergency strikes, they will be ready to serve! These outstanding hydrants keep the neighborhood safe.

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Cast integral with the nozzle section, the stuffing box plate keeps water and sediment away from the operating thread. No ice to jam the thread in freezing weather; no grit to wear out the operating thread.

AND THESE FEATURES, TOO:

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Conform to latest AWWA specifications

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Manufacturers also of Mathews Modernized Hydrants, R. D. Wood Hydrants, R. D. Wood Gate Valves, and "Sand-Spun" Pipe (centrifugally cast in sand molds)

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ABOVE: U. S. Route #25, Auglaize, County, Ohio: Bitumuls Penetration Macadam 3" Base Course with Seal Coat provides heavy duty pavement to accommodate traffic on newly constructed section of Interstate Highway.

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RIGHT: Ohio Turnpike, Eastern End, Western Division: applied over an existing macadam base, Bitumuls Single Surface Treatment gives a tight seal; excellent cover-retention for improved resistance to traffic.

Local specifications may vary from county to county, or state to state; but no matter how you designate shoulder work, the inherent economy of Bitumuls emulsified asphalt will result in important savings.

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PIPE THAT DOESN'T GET COLD FEET IN WET TRENCHES

This cast iron pipe was installed to carry water to an important industrial site in Indiana.

At the time of installation, weather conditions were severe; the trenches were wet and muddy.

Still, the cast iron pipe was easily and speedily assembled, enabling the contractor to complete the job well ahead of the deadline.

Cast iron pipe does not get cold feet over rugged soil conditions. Its rugged design, corrosion-resistant qualities, and bottle-tight joints will withstand the most severe conditions.

Modern, cement-lined cast iron pipe will deliver a continued full flow of water for at least a century . . . and rarely requires repairs or replacement.

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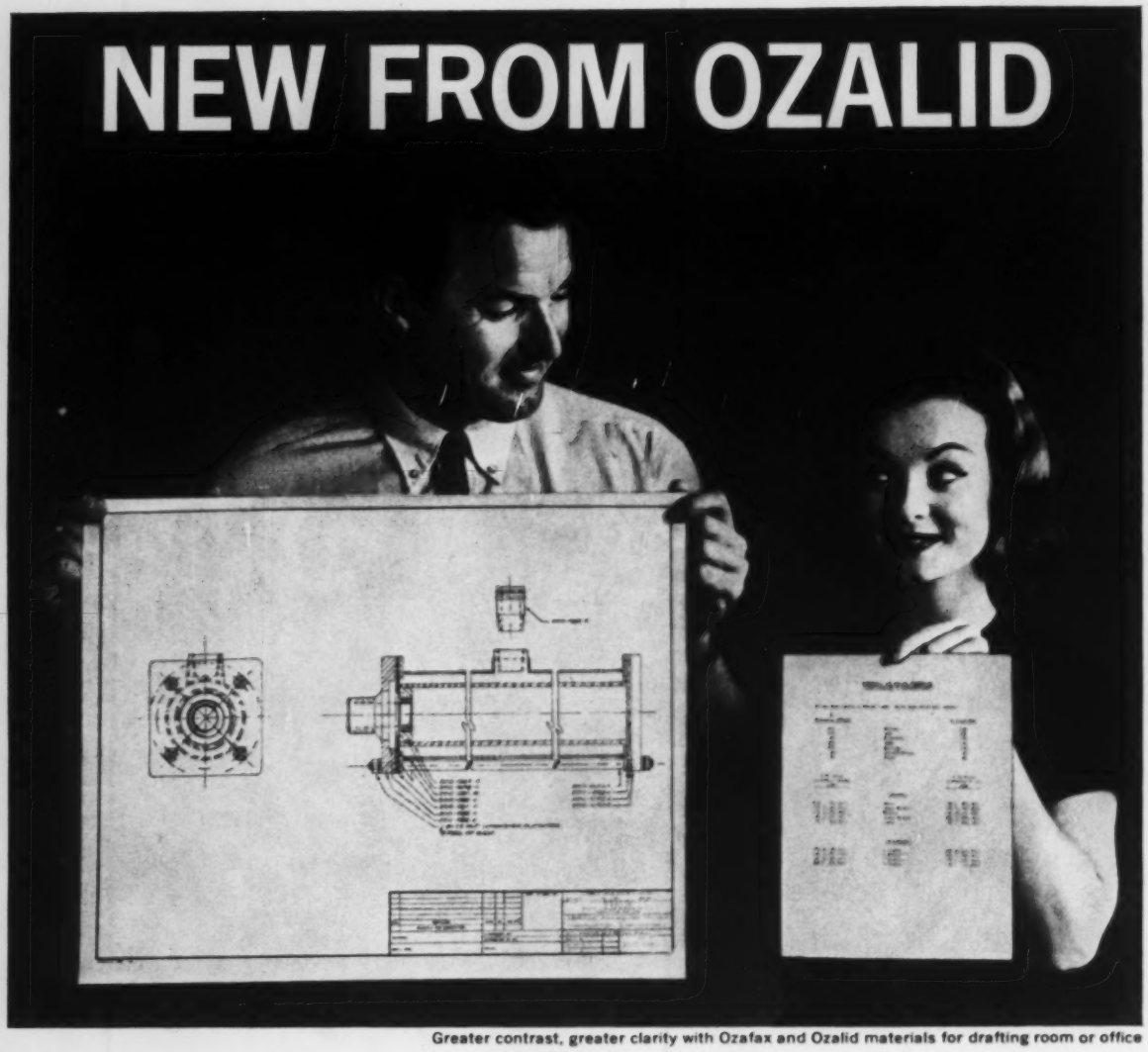

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ST CATHARINES - TORONTO - CHATHAM
FOR HUMBER SEWAGE TREATMENT PLANT

Contractor: Dravo of Canada, Ltd., Toronto.
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It's king-size for Canada, but commonplace in the United States—this 16-foot section of 10-foot diameter precast concrete pipe.

Joined by "Pressure Proven" rubber and steel AMSEAL Joints to provide a positive, water-tight seal against infiltration or leakage, over 2000 feet of the 120″ pipe is used in the Toronto subacqueous outfall sewer. Other sections include lengths of 108″, 96″, 84″, 72″ and 54″ diameter pipe.

American-Marietta's up-to-date facilities, strategically located throughout the country, assure prompt and regular deliveries. Long lengths speed installation, too, by reducing handling and joint making.

Write today for descriptive literature. Let us know if our technical staff may be of service in helping to solve your pipe problems.

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DRAWING BOARD NEWS No. 1

Published by Chart-Pak, Inc., originator of the Tape Method of drafting

CHART-PAK PRESSURE-SENSITIVE TAPES TAKE THE PRESSURE OFF MAP MAKERS

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Expert draftsmen, map makers and blueprinters say Chart-Pak's new FUTURA Drafting Film is the most satisfactory medium available. It is made of DuPont Cronar®, for exceptional resistance to heat, cracking, tearing or soiling. It is finished with a mechanically-produced matte-surface, on one or both sides — that takes pen and pencil beautifully — reduces smudging or feathering.

CHART-PAK develops new glare-proof tapes

Now, for the first time—*you* can get matte-surface acetate-fibre tapes that won't "talk back" to a camera with highlights or glare. These ingenious Chart-Pak tapes provide: a non-reflective surface, without excess thickness.

You have a thin, one-piece tape that won't reflect, cast shadows, separate, shrink, yellow or peel —in many colors and widths. Use Chart-Pak *matte-surface* tapes, wherever glare is a problem.

New folder to help you take the drudgery out of map making

For complete information on this new, easier map-making method, write for free folder—"Visualization Made Easier."

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NELSON HEADED CONCRETE ANCHORS provide up to 40% greater holding-power over larger, more costly bent anchors.

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- Anchors made of certified steel.
- A superior quality job... at no increase in cost.

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. . . . . Am-Soc Briefs

▶ ▶ Happy Birthday to us. . . . To celebrate Civil Engineering's thirtieth anniversary, this issue features urban renewal, most recent and, possibly, most vital of the many phases of the postwar building boom. North and South, East and West, the face of America is changing. Representative renewal programs in different parts of the country are described in this issue.

▶ ▶ Conventions, then and now. . . . Mint copies of the first issue of Civil Engineering made their appearance at the Society's Fall Meeting held in St. Louis in October 1930. The meeting theme was "the interrelationship between the city and its environs" and the "problems arising out of this relationship." . . . At this year's Annual Convention, which will be in session in Boston about the time this issue reaches readers (October 10–14), a major theme is again cities — urban renewal.

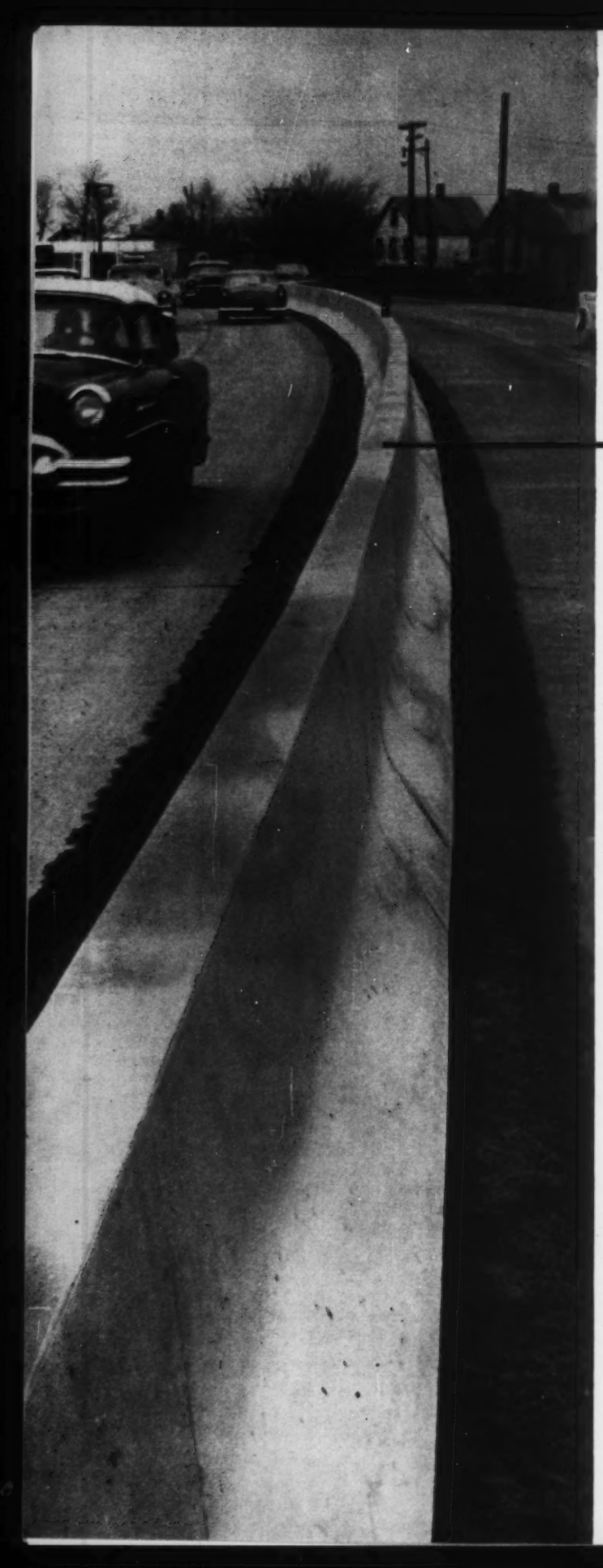
▶ ▶ Engineers united. . . . Thirty years ago the Board of Direction tabled a proposal to aid in forming a "World Engineering Federation," which had been presented to it by the World Engineering Congress. . . . Today the Society hopes and works for international understanding through the fellowship of engineers and scientists. One of many cases in point is ASCE cooperation in the Conference of Engineering Societies of Western Europe and the United States — for the past two years ASCE has held the secretariat of the group Important decisions coming out of the recent EUSEC meeting in Brussels are reported on page 98.

▶ ▶ Kudos to the Tennessee Valley Section, which finished first in percentage of individual contributions in the fund-raising campaign for the United Engineering Center — an impressive 92 percent. . . . Local Section statistics for the campaign are tabulated in the "ASCE News" section.

▶ ▶ What are the outstanding civil engineering achievements in the geographic area of your Section? Your Directors will appreciate recommendations that they can consider in assembling nominations for the 1960 Civil Engineering Achievement Award. The St. Lawrence Project won the award last year.

▶ ▶ On professionalism. . . . This time "The Younger Viewpoint" deals with the ever-timely subject of professionalism. Readers not so young will be interested, too.

▶ ▶ The Kansas City Section sponsors a big conference each November. This year the feature is Power; the place, the Continental Hotel; the dates, November 10 and 11. More on this important conference on page 98.



Unretouched photo of concrete barrier taken last spring following a severe winter.

White concrete center barriers: new safety for existing roads

This concrete center barrier on Route U.S. 46, New Jersey, has been successful in preventing head-on collisions on this heavily traveled approach to the George Washington Bridge. Cast in place with ATLAS WHITE portland cement, the barrier is 32 inches high, 24 inches wide at the base, with sloping sides. This design minimizes the possibility of vehicles mounting the barrier and helps shield oncoming headlights. This construction has become an important feature in New Jersey's program to build safety into existing highways where the installation of center islands is impractical.

ATLAS WHITE air-entraining portland cement was specified for the concrete in this installation because its uniform whiteness provided contrast between barrier and the darker pavement. And at night, this contrast is even more apparent. In addition, the air-entraining property of this cement also provides a more durable concrete that resists the destructive effects of freezing-thawing weather and the application of deicing salts. For more information on white portland cement, write Universal Atlas, 100 Park Avenue, New York 17, New York.

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CB-69

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Division of
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USS

do you know that

A new higher yield point structural carbon steel promises significant savings for the heavy construction field? Average savings will be from 4 to 6 percent, according to the U.S. Steel Corporation. The new steel conforms to Specification A36-60T for rolled structural steel recently approved by the American Society for Testing Materials (June issue of CIVIL ENGINEERING, page 116).

▪ ▪ ▪

Canada set a new record for hydroelectric installations in 1959? With the installation of 2,508,800 hp, it broke its own record set the year before for new capacity brought into operation. About 1,700,000 hp will be installed in 1960, and an additional 2,300,000 hp is either under construction or planned. Canada's total installed capacity of 24,888,426 hp is less than one-third of its feasible hydroelectric potential.

▪ ▪ ▪

Air travel in the U.S. is running well over 2 billion passenger miles a month? In August 1959 it peaked at 2.75 billion. In the summer of 1915, Orville Wright modestly said of his invention: "There is no reason why it should not take the place of special trains when there is urgent need of great speed." Thanks for this to the September issue of "Science and Appliance," issued by the Ohio State University Research Foundation.

▪ ▪ ▪

The U.S. will have the word's most powerful magnet? It will become part of a new research laboratory to be built at Massachusetts Institute of Technology under a contract with the U.S. Air Force. In this laboratory, to be built in 1961 as a national research center, materials will be subjected to continuous magnetic fields having an intensity two and a half times that currently available. The magnets will be located in eight test cells. The Boston firm of Jackson & Moreland are the engineers.

▪ ▪ ▪

Extensive new highways will be built to accommodate World's Fair visitors? Plans are being made for five highway projects as a convenience to the 40,000,000 persons expected to visit the New York World's Fair in 1964. The program will cost an estimated $94,000,000.

France has a solar-heated hotel? Scientists at the Mount Louis Solar Energy Laboratory in the Pyrenees have installed their solar-energy heating system in a large hotel in Perpignan, where it provides 80 percent of all the hot water needed for radiators, water taps, and other purposes. The installation consists of twenty-five special, 21-sq ft mirrors, inclined at 45-deg angles and facing south, which have been placed on the roof terraces of the hotel. The mirrors absorb infrared rays from the sun by means of specially treated sheets of metal, and heat more than a thousand gallons of water to a very high temperature. After the water has been brought to a boil on the roof, it is piped to two large basement storage tanks where a 140-deg F temperature is maintained. Regular circuits then distribute the hot water to every part of the hotel.

▪ ▪ ▪

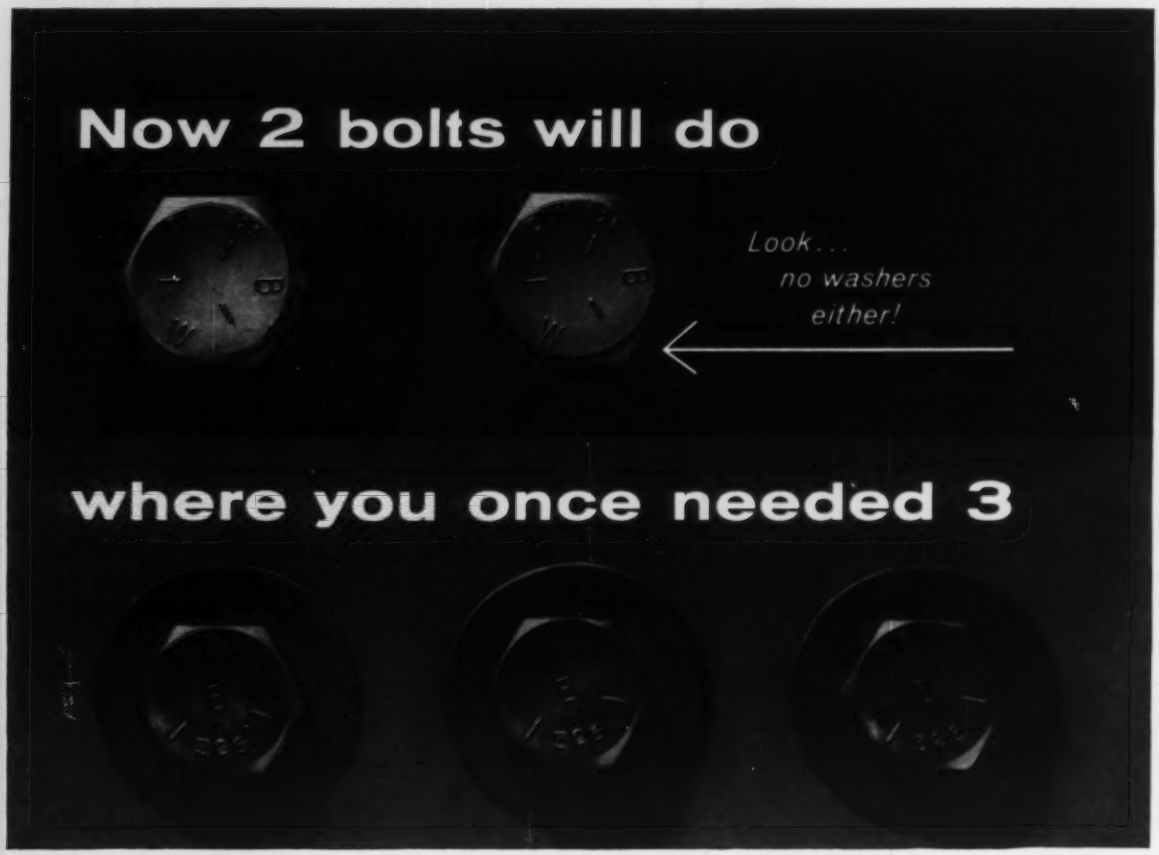
California has three out of five of the nation's large population centers? They are the Los Angeles-Long Beach metropolitan area, which now is second only to the New York-New Jersey metropolitan area in number of dwelling units. Chicago is in third place, with the San Diego metropolitan area fourth, followed by the San Francisco-Oakland area. In the past six-year period, 548,700 dwelling units were built in the Los Angeles area, compared with 525,800 in the New York area.

▪ ▪ ▪

One-quarter of the world's hospital beds are occupied by people ill because of poor water? This sorry situation—reported in Purdue University's "Sanitary Engineering News"—highlights the importance of the National Water Pollution Conference, set for Washington, December 12-14. The conference is especially concerned with the long-range effects on human health of the wide range of detergents and chemical contaminants that pose new and difficult problems for the sanitary engineer.

▪ ▪ ▪

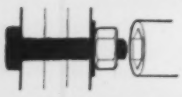
U.S. industry lags in training offers for foreign students in an exchange program? Because of a lack of response for the reciprocal program, only 53 percent of U.S. student applicants (a total of 98) were able to go abroad for training in foreign countries last year. Some countries with considerably less resources than the U.S. place over 1,000 engineering and science students each year. Leaders in the program are West Germany and England. The U.S. program is administered by the U.S. Committee of the International Association for the Exchange of Students for Technical Experience which is under EJC sponsorship.



...when you connect bearing joints with new design RB&W High Strength Bolts

Majority of structural steel joints are bearing-type joints. This is precisely the type that can now be connected *faster, at less cost,* and *with full design strength* by taking advantage of the new large head RB&W High Strength Bolts.

Their shorter thread length assures that the shear plane of the joint will not pass through a threaded section (see sketch). Full shear strength of the bolt is now realized. Two bolts can do the work of three regular bolts . . . or replace three rivets.



In addition, the new larger head enables bolt to be torqued up to full recommended tension without any crushing of the bearing surface. Use one washer only—under the bolt head or nut, whichever is rotated during the wrenching.

This exciting new fastening improvement has been thoroughly tested under the auspices of the Research Council on Riveted and Bolted Structural Joints and is now approved by both the Council and the AISC.

As a leader in pressing for this now recognized improvement, RB&W is producing a full range of bolt sizes, all conforming to ASTM A 325 specification, all with *certified* quality. Start immediately to profit from the engineering, shop fabrication and field erection advantages afforded by RB&W High Strength Bolts. Send for details.

RB&W
116th year

Plants at: Port Chester, N.Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Additional sales offices at: Ardmore (Phila.), Pa.; Pittsburgh; Detroit; Chicago; Dallas; San Francisco. Sales agents at: Cleveland; Milwaukee; New Orleans; Denver; Fargo.

LARGEST INDEPENDENT PRODUCER OF HIGH STRENGTH BOLTS FOR CONSTRUCTION

Public housing and slum clearance, sponsored and partly financed by the U. S. Government, are developments of the past thirty years. Here, Mr. Dickman, a member of the Urban Renewal Committee of ASCE's City Planning Division, reviews the history of urban renewal by tracing federal legislation on housing.

Urban renewal and federal legislation

R. L. DICKMAN, M. ASCE, Director of Planning and Urban Renewal
Vogt, Ivers, Seaman & Associates, Cincinnati, Ohio

Urban renewal is perhaps one of the most publicized and least understood programs in this country today. To provide an adequate understanding of the program and to develop the full meaning of the term "urban renewal," it is necessary to review the activities of the Federal Government in the housing field.

When this country was young, one of the most respected rights was that of the landowner to use his property as he desired. This attitude, plus the feeling that personal initiative should not be restrained; was responsible for the lack of any significant control or guidance in the use and development of land, including housing development. During the crucial years when the foundations of American communities were being laid, this philosophy prevailed.

Until 1930 the housing activity of the Federal Government was restricted to routine reports, investigation of standards, and research to supply information to private enterprise. During World War I some government housing projects were built, but these were soon liquidated and the houses sold to private enterprise. It was not until the chaotic depression of 1929-1933 that the Federal Government entered the field of housing extensively. At first the legislation consisted of emergency measures, but these eventually formed the basis for the future housing policy of the Federal Government.

Through the years 1929-1933, the greatest volume of urban foreclosures in the history of the country took place. In an attempt to stem this tide, Congress, in July 1932, authorized the formation of the Federal Home Loan Bank, on recommendation of the Conference of Home Builders and Home Owners. The bank proved inadequate, and in 1933 the Home Owners Loan Corporation was authorized by Congress under the direction of the Federal Home Loan Bank Board. By making direct loans to stop foreclosures, the HOLC helped to promote recovery.

Depression legislation

During depression years, other legislation in the field of housing was enacted by Congress to promote recovery. The Reconstruction Finance Corporation Mortgage Company was authorized to refinance mortgages on apartment buildings, hotels and other business properties not provided for by the Home Owners Loan Corporation. To aid farmers, the Federal Farm Mortgage Corporation was established. The Emergency Relief Construction Act authorized RFC loans to state-regulated, limited-dividend corporations. This was the first act to offer direct federal aid in the construction of housing.

The National Industrial Recovery Act transferred the housing power of the RFC to the Housing Division of the Public Works Administration. This act provided for the "construction, reconstruction, alteration or repair under public regulation or control of low-rent housing and slum clearance projects." Thus, with the National Industrial Recovery Act of 1933, was born the policy of public housing.

The National Housing Act of 1934 authorized the establishment of the Federal Housing Administration. During the 1930's the FHA and the Federal Home Loan Bank System represented the principal housing finance agencies of the government. However, the two systems resulted in two policies, and in 1939 the Reorganization Act brought them together. But still there was no basic reorganization. Meanwhile, in 1937, the United States Housing Authority was established to replace the Housing Division of the PWA to provide for lower income urban families.

By the beginning of World War II, federal housing policy had come a long way as a result of the emergency action taken by the government in the housing field to help prevent recurrence of a financial catastrophe. However, the activities of the government were not guided by one housing agency or system, but by several. For this reason, the President, in 1942, under his wartime powers, consolidated all housing agencies under the new National Housing Agency. In the new organization three constituent units were established—the Federal Housing Administration, the Federal Home Loan Bank Administration, and the Federal Public Housing Authority.

The problem of blight

Up to this time government housing policy had been based on emergency measures. At times the measures were incomplete, chiefly because the housing problem was looked on as a means of solving broader economic or social problems, rather than the basic problems of housing. However, under the wartime program the basic problems were at least faced. The effect of migrating defense workers during the war, the lack of housing production by private enterprise, the expected housing shortage for returning veterans, and the continuing spread of blight in American cities pointed to the need for a comprehensive approach to the basic housing problem. Since urban renewal is primarily concerned with blight, further discussion here will be limited to that phase of federal policy and legislation.

Blight has been a major problem in most American cities since the turn of the century. As has been mentioned, the first attempt in the form of federal aid to assist cities in meeting the problem was the Public Housing Program.

The low-rental public housing program was initiated to improve the miserable living conditions of families in hopelessly blighted areas and to replace these areas with decent, safe and sanitary accommodations at rents the families displaced could afford.

The prime motivation for this housing was sociological and at times it was carried out at the expense of principles of good economic and physical planning. Some projects were put on land that could have been used for a higher and better use. Density was established by the "equivalent replacement" formula, that is, one new dwelling unit for each unit demolished.

A substantial number of hopelessly blighted dwelling units were eliminated as a result of the program. However, it soon became evident that the program was not the total answer to the problem of blight. Blighted areas in American cities were too extensive to be completely rebuilt with public housing, and the volume of low-rental housing under such a program would grossly exceed total requirements. It was recognized that some public housing was necessary, but that a new approach was needed if any substantial gains were to be made in the control of blight.

Highest economic use

Such enlargement of the program was provided by the Housing Act of 1949, generally referred to as the Slum Clearance and Redevelopment Act. Its provisions generally maintained the sociological motivation of the Public Housing Program but placed more emphasis on economic and physical planning. Whereas the primary purposes of the Public Housing Program were to eliminate blighted residential areas *and* to provide decent low-rent housing, the criteria for federal financial aid under the 1949 act was to eliminate blighted residential areas *or* to provide decent housing.

In other words, if a city applied for federal funds under the act to clear a blighted, predominately residential area, the reuse of the cleared land had to be the highest and best use as determined by sound principles of economic and physical planning. Furthermore, areas not required for public facilities had to be developed by private enterprise. In cases of non-residential blight, federal aid was available for clearance, provided that sound economic and physical planning principles indicated the best reuse to be residential.

The financial-aid formula in the act provided federal funds for grants to local public agencies for two-thirds of the net cost of a project. The net cost is the difference between the gross cost and the proceeds realized from the sale of cleared land to private developers. Federal loans were also authorized for interim financing.

For the administration of the redevelopment and other housing programs, the 1949 Act established a central housing agency, the Housing and Home Finance Agency. This act was heralded as salvation for cities choked with ever spreading blight. Cities across the country submitted applications for aid, and all were hopeful that the end of slums was in sight. However, these hopes were soon dimmed by an array of obstacles. Such problems as the need for state and local legislation, litigation to establish constitutionality, irate property owners, general public misunderstanding, and federal procedural requirements, all delayed any significant accomplishments for several years after the enactment of the legislation.

When the stage of actual demolition was reached, it became possible to evaluate the time element involved in slum clearance under the new legislation. It became increasingly obvious that slums were spreading at a faster pace than they were being cleared away.

Such was the conclusion reached by the President's Advisory Committee on Government Housing Policies and Programs in 1953. The Committee had been appointed by the President to recommend ways and means to combat the increasing threat of urban blight, increasing in spite of the Slum Clearance and Redevelopment Program.

The recommendations of the committee were basically threefold:

1. To continue federal aid for slum clearance and redevelopment.
2. To supplement the clearance program with aid for neighborhood improvement by rehabilitation and conservation of older areas.
3. To require localities to demonstrate their intent to attack the problem of urban blight on a comprehensive basis.

These recommendations provided the framework for a total approach to the problems of urban blight. With provisions for slum prevention as well as slum clearance, and a requisite for local initiative, the concept of "urban renewal" was born.

The President subsequently requested legislation from Congress to implement the recommendations of the committee. Congress responded with the Housing Act of 1954. With the passage of this Act, federal financial aid was made available for neighborhood improvement as well as for slum clearance. The formula for such aid remained generally the same as in the 1949 Act, a federal grant for two-thirds of the net cost involved.

The 1954 Housing Act also implemented the recommendation concerning local initiative. To assure such initiative, a locality, to be eligible for federal aid, must first demonstrate it has a "workable program" for the elimination and prevention of blight. To demonstrate this, the locality must commit itself to the following basic objectives:

1. Adequate codes and ordinances for housing occupancy and building construction.
2. A comprehensive planning program.
3. Neighborhood analysis to identify problems of blight.
4. Adequate administrative organization.
5. Adequate financing for a total program.
6. A policy to assure relocation of displaced families to decent, safe and sanitary housing.
7. Maximum citizen participation in the total program.

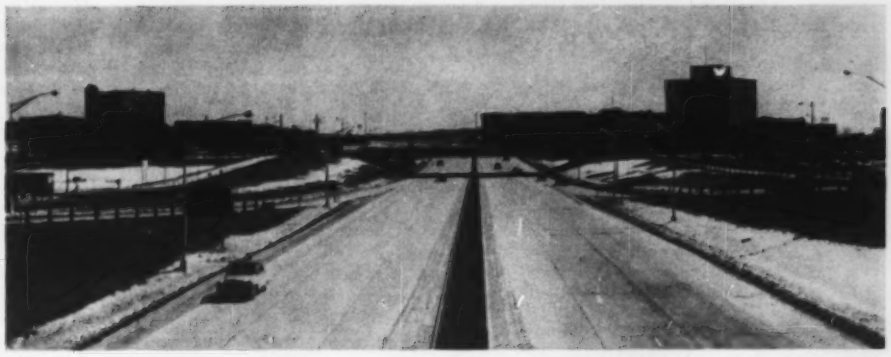
Although the workable program concept is a prerequisite for federal financial aid in urban renewal, it is, more importantly, the logical first step a community should take for a successful program of blight elimination and prevention.

Concept now stable

Since 1954, numerous amendments have been made to urban renewal legislation but there has been no change in the basic philosophy as contained in the recommendations of the Advisory Committee. What changes have been made are directed at specific problems such as relocation of families, financing, procedural requirements, elimination of commercial blight, and so on. The program is administered by the Urban Renewal Administration of the Housing and Home Finance Agency, created in the Housing Act of 1949. There are six regional offices throughout the country to aid communities in initiating an "urban renewal program."

Activities of the Federal Government in the field of housing began with the emergency measures of the depression years and have evolved to the total approach to the housing problem through urban renewal. At this time it is estimated that there are 797 projects in 456 communities using federal aid, of which over half are in the execution stage or completed.

The evolution of the renewal concept demonstrates the national implications of bad housing. "A decent home and suitable living environment for every American family" is the basic goal. Once this goal is reached, one of the first requirements for a healthy and stable national economy will have been attained.



Oak Street Connector links downtown New Haven with the Connecticut Turnpike and will provide access to the central business district for 65,000 vehicles daily. Jointly financed by the state and the Federal Government, this $15 million expressway link replaces a former slum area. This expressway is typical of the vital part that highways play in urban renewal.

Traffic and Transportation in URBAN RENEWAL

WILBUR S. SMITH, F. ASCE, Wilbur Smith and Associates, New Haven, Conn.

Present emphasis on the Space Age and the possibilities for exploration it holds for earthbound man have caught the imagination of all. Yet a space project that all too often is dismissed with a shrug of the shoulders is right here in our own backyard—the downtown space problem. This problem takes shape in the form of congested streets, poor access, shortage of parking facilities, crowded slum areas, and lack of sufficient space for expansion of commercial, residential, and civic facilities.

Faced with an unfavorable competitive situation and a decaying economy, more than 80 cities are currently engaged in some form of revitalization of their downtown areas. Others must take similar steps if they are to remain good places for working and living while maintaining their competitive position. The city fathers propose to reconstruct the outmoded areas through urban renewal, which has been defined as "the total of all the public and private actions which must be taken to provide for the continuous sound maintenance and development of the urban area."

Opportunities for traffic improvement

Although urban renewal offers a potential solution to the more serious problems facing deteriorating central business districts, it cannot succeed unless renewal plans are coordinated with traffic and transportation planning. The establishment of greater traffic generators without proper facilities to accommodate the extra load only creates additional problems. The resulting congestion might well nullify other attractive features of the redeveloped area. By the same token, accelerated expressway programs, street improvements, and even mass transportation plans will fall short of their objectives and possibly have negative effects on the future of metropolitan areas if not made a part of urban renewal plans.

The transportation aspects of a renewal project must provide for the fullest capacity and highest rate of movement possible on fixed street widths, with controlled intersections. The traffic performance on streets within a renewal project should considerably exceed that of older streets in adjacent areas. The efficiency of new streets can thus serve as a standard, encouraging improvements on inadequate existing streets. Adjacent areas must be studied intensively to be sure that adequate avenues of ingress and egress can be developed and integrated with projected major improvements. These avenues should include all forms of transportation—rail, rubber transit and private car.

While the best solution for transportation problems will vary from one community to another, it is a general thesis that a "functional segregation" of traffic is desirable. For example, it should not be necessary for traffic desiring to enter the central business district to intermingle within the district with traffic that only wants to go through.

Wherever it is possible, the movements of vehicles and pedestrians should be segregated. In many urban renewal projects, it will be entirely feasible to physically segregate most types of commercial and other traffic. Transit also operates most effectively when physically separated from other forms of traffic, either in special street lanes or on its own right-of-way.

The various patterns that have been conceived for downtown renewal projects all offer effective means of traffic handling, including terminal facilities.

Examples described

In New Haven, Conn., a plan is being developed that will basically separate much of the pedestrian traffic by placing it on an elevated mall. The entire project is tied to a major expressway connector. A large part of the project will be served by an underground roadway that will bring commercial vehicles into the area without conflicts with other traffic. Parking facilities will be strategically located to intercept movements off the expressway and from most directions of entry

into the central area of the city, thus minimizing the amount of travel that will be required on local streets. Otherwise, the street system will replace the original gridiron plan, but with additional capacity afforded by widenings.

In Miami, Fla., there is talk of a downtown plan that will, in effect, provide for the construction of "super blocks" within a tight core circumscribed by an expressway loop. Contemplated major projects in the downtown area are being developed in cooperation with highway agencies.

For downtown Newark, N. J., a modified mall has been recommended. The mall would provide the conventional advantages of such facilities and afford a pedestrian-way largely uninterrupted by vehicular traffic. It was found, however, that some key arteries must be maintained across the mall because of insufficient capacity to accommodate traffic movements into and through the central area. The plans will be coordinated with parking, expressways, and public transportation, including rail transportation.

For Lansing, Mich., the downtown redevelopment would be largely accommodated by a mall plan. Public transportation would be provided through the mall, but other types of vehicles would be excluded.

In Tulsa, Okla., a very interesting plan has been developed, including a 12-block pedestrian mall. All vehicles would be excluded. About 2,500 new parking spaces will be provided. A one-way street network will connect the parking areas to an inner dispersal expressway loop of the central business district.

Aware of the necessity for coordinating development plans of the future downtown area with expressway programs, some planners have proposed revolutionary ideas. In England, architects have come up with a plan that features the construction of roads at roof-top level. Structures roofed by the roads would contain dwelling units and shops. Other facilities—schools, churches, municipal buildings, etc.—would occupy the rectangular park areas formed by the intersecting streets.

Similar thinking is being done in the United States, as evidenced by plans for Horizon City, a futuristic metropolis planned for a site three miles outside El Paso, Tex. The project features an oval-shaped center plot containing a 350-acre park with an artificial lake and two heliports—and the complete separation of vehicular and pedestrian traffic.

A master plan essential

Unfortunately, in too many cities urban renewal projects arrive on the scene prematurely in relation to other essential developments. A community contemplating an urban renewal project is seriously handicapped if it has no overall master street plan as part of a general city plan. Without a basic plan, locations for the project must be made largely on conjecture. Future expressways, access arteries, one-way streets, an efficient traffic circulation plan, and suitable facilities for parking may require extensive revisions at substantially higher costs.

The federal road building agencies are encouraging comprehensive planning by suggesting that the highway planning funds available through federal aid be used by the state highway departments in cities for broad planning purposes—not just for traffic planning. Some state highway departments, for example North Carolina's, have acted under enabling legislation and requested that communities develop total plans before they participate in urban-expressway and major-route projects. The National Committee on Urban Transportation is doing much to foster overall planning and encourages the integration of expressways and other highway transportation plans, as well as mass transportation plans, with total plans of metropolitan areas.

There is of course another very important reason why overall planning is essential—highway facilities and urban renewal facilities must be based on conditions expected in some future design year. This means looking ahead 15, 20, or more years.

Methods of predicting travel and transportation needs for future years are now closely interwoven with anticipated land uses of the future. A "hen-or-egg" situation arises: the transportation needs of the future cannot be accurately forecast without knowing the expected land uses of the future, and conversely the land uses of the future will be, to a large extent, dependent on the adequacy of the transportation facilities that can be provided.

Traffic projections

The problem of assuring that the desired amount of traffic can get to and from a renewal area at a satisfactory rate of movement can be a complex one. It involves projecting traffic needs to future years. Projection of trips involves two distinct areas of analysis: (1) estimates of the number of trips that the land uses in each subdivision or zone in the study area are likely to generate, and (2) the travel patterns likely to result when trips are distributed between termini.

In practice, it is possible to make reasonable and satisfactorily accurate estimates of the number of trips that will be generated in each zone from consideration of various land-use and population factors. The rates of trip production can be determined from analyses of current origin-destination data, or they can be estimated with a fair degree of accuracy from relationships found in other metropolitan areas with similar characteristics.

The projection of inter-zone travel patterns is a much more complex matter. Reliable forecasts can be obtained by a thorough analysis of current origin-destination data to establish relationships between the basic motivations and characteristics of urban travel. These relationships are applied to a given set of land-use statistical data which produce the most likely travel patterns that could be expected under specified conditions.

Since urban renewal projects change patterns of land use substantially, projections must include a thorough study of the traffic that will be generated by businesses or structures to be built within the area. These include such items as commuters, shoppers, transit riders, prospective parkers, trucks required to deliver merchandise for sale, trucks required to deliver merchandise sold, volume of pedestrian traffic, peaks of arrival, accumulation and discharge, and origin and destination of generated traffic.

Parking and terminal facilities

Regardless of how attractive an urban renewal project may make a central business district, its overall objectives will not be achieved if parking difficulties remain. Off-street loading bays for commercial vehicles, off-street loading platforms for passengers, and off-street parking capacity must be comparable to the demands generated by new buildings. Only by this process can all street space be used exclusively for the movement required for a central business district to compete successfully with business in less congested and less concentrated areas.

Indicative of the emphasis on parking in urban renewal projects is the previously cited redevelopment in New Haven. This giant undertaking, affecting 138 acres in and adjacent to the downtown area, includes a multi-lane expressway connector to the Connecticut Turnpike. The City of New Haven will construct off-street parking facilities to be integrated with the project at a cost of $7,000,000. A shopper's garage, containing parking for 1,500 cars, will have direct access to the retail shopping area and will be conveniently located for all downtown shopping. This project, and parking lots along the connector with 1,500 spaces, will be built by the city's Parking Authority and leased to private operators.

In St. Louis, Mo., thought is being given to construction of fringe parking facilities leading directly off the expressways, with transportation to the high trip generation areas of the central business district by bus, transit or moving sidewalks.

Orlando, Fla., is planning to make full utilization of an Interstate expressway through the downtown area. Originally,

plans called for the new route to be constructed on an embankment. Working in close cooperation with highway officials, the Orlando Parking Authority succeeded in getting plans altered to have the highway constructed on an elevated structure. The parking authority will pay the difference in cost in exchange for use of the area underneath and unused rights-of-way for parking. The difference in cost is to be financed with revenue bonds.

Other cities are also working with highway planners to make maximum use of areas under expressways and "left-over" right-of-way areas for parking. Such arrangements are taking on increased importance as land becomes less plentiful and as more space is utilized for broad expressways and arterial routes.

Construction proceeds on a 1,500-car garage in downtown New Haven. This $4,500,000 structure, to be completed next summer, will be accessible from the Oak Street Connector.

Public transportation

Highways are essential, but they must function as part of an overall method of bringing people into, out of, around and through the central business district. Despite the onslaught of growing private automobile traffic, public transportation by railroad, subway, and long-distance and local buses plays an essential role in the economic life of the central business district. Good public transportation must be integrated in urban renewal planning. Without it, renewed areas are likely to become choked again with vehicles that can find no place to stop or park.

The new freeway running west from the heart of downtown Chicago, Ill., with its provision for high-speed electric service between inbound and outbound auto lanes, is often cited as a good example of integrated metropolitan transportation planning.

Los Angeles, Calif., likewise has recognized the necessity for supplementing its elaborate network of freeways with some form of mass transportation. This area is an extreme example of the sprawl of metropolitan urban and suburban areas without the benefit of extensive, integrated, rail transportation lines. Consideration is now being given to the establishment of a rapid transit system which, according to a recent study, would be feasible for the area.

In Philadelphia, Pa., where considerable urban renewal work is in progress, the city has formed a tax-free, non-profit corporation to run commuter railroad lines. The Passenger Service Improvement Corporation of Philadelphia is apparently the first of its kind in the nation.

There are a few encouraging signs. For example, public agencies in New York, N. Y., recently released facts showing that rapid transit riding in that metropolitan region has shown a substantial increase during the past seven months. Other major cities have reported some upturns in transit riding curves in recent months. Whether this is indicative of a "swing-back" to transit remains to be seen, but it can, at least, be pointed to as an encouraging sign.

Now that the importance of rapid transit has been established, at least among most community leaders, public understanding and acceptance of it must be achieved. Transit must demonstrate what it can do to alleviate traffic congestion, and how. Specific plans —on a street-by-street and route-by-route basis—must be presented for cities to use transit constructively as a positive tool to unsnarl downtown vehicular traffic.

Implementing transportation plans

In many respects, an urban renewal project is similar to other major developments, such as a large regional shopping center. To promote it successfully requires a combination of qualified talents. Because of the tremendous expense involved, a renewal project obviously warrants the employment of a team of experts in various fields to assure that full value is realized regarding long-range improvement in the central business district.

In addition to coordinating efforts in planning a comprehensive program, methods of financing must also be given careful consideration.

On the highway transportation aspects alone, several levels of government are involved—the federal, state and city governments, and often the county. Complete understanding and good working relationships are essential for efficiency and proper programming.

The Oak Street Connector is shown in the upper right as it enters the central business district of New Haven, Conn. Connecticut Turnpike is in the background. New buildings and cleared areas are evidence that revitalization of the 44-acre former slum area is well under way.

URBAN PROBLEMS OF EXPLODING CALIFORNIA

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It is expected that population growth in California during the next twenty years will surpass any growth anywhere in the world any time in history. A continuation of the present population increases and urbanization trends indicates that California's present population will double by 1980.

The following is a review of the conditions and a proposal for the correction of conditions of blight in California within the next twenty years.

First, the terms used here should be defined. By urban California is meant present and future urbanized areas of the state.

By blight is meant especially, but not only, substandard housing, incongruously mixed land uses, obsolescence in buildings, streets and other public facilities, inadequate community facilities, poor planning or platting, economically stagnant conditions of land, or tax liabilities, where cost of city services exceed the tax revenues from the blighted area. By urban renewal is meant a comprehensive treatment of blight through conservation, rehabilitation, and redevelopment or clearance and rebuilding.

Phenomenal growth

In 1950 the population of the State of California was 10,586,223 persons according to the Bureau of Census. Today the count is estimated by the Bureau of the Census at 15,500,000. In 1950, of the total population, 8,539,420, or about 80.6 percent, were urban and the remainder rural, as determinel by the Bureau of the Census. The trend toward an increasing ratio of urbanization leads us to believe that in 1960 nearly 14 million persons, or 90 percent of the total, are urban dwellers.

A continuation of these population increases and urbanization trends would indicate a population of 27.6 million in California in 1980 or 26,200,000 in urbanized areas, representing 95 percent of the total according to the Los Angeles Chamber of Commerce. This is conservative compared with the forecast of 30 million urban inhabitants for the entire state in 1980 by Richard Carpenter, Executive Director of the League of California Cities (State Chamber of Commerce Conference on Metropolitan Transportation Problems, February 25, 1960).

In 1950 there were 3,590,660 dwelling units in California, 2,901,811 of them in urban areas. A total of 510,660 dwelling units in California in 1950 were rated by the housing census as substandard, of which 301,800 were urban. In 1960 it is estimated there are 5,230,000 dwelling units in California based on the current estimate of population, of which 4,070,000 are urban dwelling units.

Substandard housing

During the past decade there have been numerous public and private developments such as freeways, office buildings, and apartment developments that have eliminated some of the substandard housing conditions in California. New dwelling units built during the past decade would be counted as standard. On the other hand, some of the dwelling units built before the last decade and rated standard in the 1950 census of housing have fallen from the standard to the substandard category. Assuming these forces have offset each other, there would be the same proportion of substandard dwelling units in California now as there were in 1950.

On this basis there is an urban renewal work load of 410,000 substandard dwelling units to correct through rehabilitation or to eliminate through redevelopment within the next twenty years. This is only 20,500 dwelling units a year. The Los Angeles Bunker Hill Project itself eliminates nearly 5,000 substandard dwelling units. At the same time other conditions of blight—such as mixed land uses and street deficiencies—would be corrected.

In California there are only 30 communities with redevelopment agencies. After ten years of federal legislation and fifteen years of state enabling legislation for urban renewal, the need for acceleration of the use of this important municipal tool is evident. It is conservative to say there is need for an additional 80 redevelopment agencies, including those in some of the counties as well as the larger incorporated cities.

This huge task is important not only to eliminate substandard housing and

other conditions of blight but also to prepare these urban areas for the tremendous future growth ahead resulting from normal population increases plus the attraction to the area of those out-of-state people seeking a better place in which to live and work.

$86.6 billion for building

It is estimated that there will be 4,220,000 dwelling units built in California to house the urban population growth in the next twenty years. At an average cost of $15,000 per dwelling unit, this represents an investment of $63.3 billion for housing needs alone. In addition, the commercial facilities to serve this increase in population in the form of office space, warehouses, shopping centers and the like should require an investment of another $15.5 billion (based on contract data on pages 745 and 755, Statistical Abstract of the United States for 1958, U. S. Government Printing office).

The industrial capacity for the manufacture of goods needed by this population increase in the next twenty years requires an estimated investment of an additional $8 billion. This is a total of $86.8 billion for private development only, exclusive of land cost. We know that most of this development will take place in the vacant areas surrounding existing cities but we also know that the older parts of these cities are in a state of deterioration where urban renewal is needed and where a substantial part of this growth will take place.

In the first half of the twentieth century city planning has evolved from a predominantly "esthetic" or "city beautiful" approach to a pragmatic professional attitude which recognizes the necessity of guiding urban growth through a master or general plan of land uses, community facilities, and communication systems. The general plan is influenced by physical, economic, sociological, and cultural aspects as well as the esthetic features of the city.

Now there is a new element added to the general plan—the master plan for urban renewal. Here is a singular opportunity to convert a tax liability to an asset, eliminate substandard housing and obsolete non-residential buildings, and then to supply the demand of the modern city for the late types of improvements, such as office buildings, shopping centers, apartments, bus or truck terminals, industrial plants, traffic ways, and public buildings and facilities—all according to a coordinated master plan.

The master plan of urban renewal pin-points the blighted areas of the city, and a program is formulated to correct each condition of blight through conservation, rehabilitation, or redevelopment. The plan delimits project areas and schedules their renewal. If work on such plans were started now in California the state could be free of blight in twenty years.

Planned urban renewal

If it is assumed that a mere ten percent of this future growth in the next twenty years in California can be channeled into the rebuilding of obsolete and deteriorating areas, more than $8 billion of private capital investment would be available to promote hundreds of urban renewal projects. Let us assume that neighborhoods with populations of 5,000 persons each are developed within the next twenty years to accommodate the population increase of 12,400,000. This means that more than 2,400 such neighborhoods would be created, and if 10 percent of them, or 240, could be channeled into urban renewal project areas, a great opportunity would be created to eliminate substandard housing and other conditions of blight. In each of these urban renewal projects there would be an average private investment of millions of dollars. The resulting benefit to the tax structure of California communities would be enormous. The existing assessed valuation of real property in excess of $22.7 billion (from Table 21, Taxable Property Values in the U. S., 1957, Bureau of the Census) in the state would more than double in these twenty years, producing a firm tax base for meeting the cost of the increasing city services demanded.

Procedural improvements

Renewal legislation was written before there was any actual urban renewal in the modern sense of the term. Naturally, renewal law has unforeseen shortcomings and complications. But as the work goes forward, its legal basis can be revised and strengthened and practical interpretations of the law can be worked out. Here are some cases in point:

1. Relocation of site occupants is the most important part of renewal to some and the least important to others, One group sincerely believes that since relocation of site occupants is not required for other governmental action, forcing it on urban renewal officials slows up the program unjustifiedly and delays the economic benefits of renewal accordingly. The other school says that relocation is an opportunity to avoid self-relocation of site occupants back into substandard housing and neighborhoods, and to get across to them the value, particularly in the case of families with children, of an adequate environment. Relocation is a legal requirement to live with and work with. Each family should be treated as kindly and at the same time as practically as possible. But our good intentions should not be forced on those who do not need help.

2. Marketability of land made available through redevelopment is a key point in any renewal project. A qualified land economist is an essential member of the team of planners, engineers, architects, lawyers, and financiers who are responsible for determining the land reuse. Caution should be exercised in jumping to conclusions on the type of land use by reasons of popularity, community pressure for a dump or any other public use, or to avoid revision or updating of an otherwise practical master plan. The increase in tax revenue from the project area may be the key to the financial feasibility of the project. The land reuse and marketability of the land is therefore a critical determination made best by an expert land economist.

3. Planning of public improvements and urban renewal projects should precede by several years the actual work of either so that needless waste of funds is avoided, and conversely, so that maximum advantage can be taken of these public expenditures in formulating a financial plan for the renewal project. This is one of several instances where a general plan is essential.

4. All possible sources of private or local funds for urban renewal should be explored to avoid the political uncertainties of continued loan and grant appropriations by the Congress.

5. Last but not least is the encouragement of community-wide support and understanding of urban renewal. The citizens and various organizations should be informed of the many benefits to all the people, the prohibitively high future cost of not renewing now, the rights of the people under the Constitution, and the legal protection of the individual.

In urban renewal work it is easy to become so involved in project details, intricate financial proposals and planning techniques as to lose sight of the primary purpose of the work—the people and their welfare. The bad urban environment with its noise, delay, bad air, congestion, deterioration, and obsolescence can be improved through sound planning and workable urban renewal. Life in the city can be quiet, dignified, clean, profitable, and efficient for every individual who lives there.

12-acre Constitution Plaza site with new highway system at the Connecticut River crossing. Construction on all buildings will be under way this year, with completion planned for late 1963.

A constructor gets into urban renewal

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The nation's urban renewal program—the Title I section of the 1949 Federal Housing Act—could well be a boon to contractor-engineers across the country, just as it has already provided gainful employment for thousands of civil engineers. This massive $1.6-billion urban rebuilding program not only opens a new vista for high-volume business for engineering and construction firms, but more important, it is an area in which the contractor-engineer should be a leader, not a follower.

The recreation of functional, durable, attractive downtown centers, besides being a fertile field for new business, presents a challenge—fraught with opportunity for imagination—to the engineering profession, a challenge that should be answered if we are to assume community leadership.

Urban renewal is a field in which the architect, engineer, and contractor must work harmoniously together under a new professional title—the redeveloper. The role of redeveloper is a relatively new one and until recently has been preempted by those in the real estate field. Unlike the realtor, who can make a profit on a single parcel, the urban redeveloper is concerned with large assemblages of property. He must follow a philosophy that embraces an overall concept of civic improvement and may spend many years of concentrated effort on such a development. Study led us to believe that urban renewal requires talents not exclusively possessed by the real estate industry. The redeveloper has to have a sense for city planning, real estate values, financing, legal aspects, building design, building

management, salesmanship, public relations, and of course engineering and construction.

There have been some outstanding private redevelopment projects in the past thirty years. The list includes New York's Rockefeller Center, Cleveland's Union Terminal area and Kansas City's Plaza district. Grand Central Terminal and nearby Park Avenue in New York City were completed earlier. The basic differences between these magnificent developments and an urban renewal project are that under the urban renewal program the city gets a federal subsidy for the acquisition of land and can take parcels from reluctant owners by right of condemnation. The subsidy applies only to land acquisition and not at all to construction. Except for the subsidy on land acquisition, the redevelopment in Hartford, Conn., is strictly a private venture.

This large, first-class redevelopment project pending in the company's home town was the primary reason why F. H. McGraw & Company became interested in urban renewal. That was in the winter of 1958. The Hartford project, known as Constitution Plaza, is now under construction and when completed in 1962 may well be hailed as one of the nation's outstanding urban renewal accomplishments. Much that we learned may be of value to interested contractor-engineers.

The first act of F. H. McGraw & Company on the Hartford project was to put to ourselves and to the city the question as to the company's eligibility as a redeveloper. Of course construction contractors frequently have promoted and built a unit or two of a development; it is seldom that they have taken over a whole project.

We found that the company had just about all the necessary talents to become a redeveloper and that we were as eligible as any other contender. Our company was encouraged to participate in the Hartford program—on a competitive basis. We accepted this challenge and subsequently accepted invitations to participate in two other urban renewal projects in New England. There were already two well-known applicants for the privilege of rebuilding downtown Hartford; one was a large real estate development firm from New York City and the other a New York construction firm, which subsequently merged its interest with that of a local developer.

When McGraw entered into preliminary negotiations for the Hartford redevelopment project, the city had designated 11.5 acres of its downtown section for renewal. This was later increased to 15 acres through a state grant. The land had been acquired, some of it by condemnation, and demolition of slum housing and decadent structures had commenced. Some residents and commercial tenants had already been relocated. There were originally 330 families living in the area and 106 businesses located there.

Steel columns rise for the five-story $2,000,000 Broadcast House, which is scheduled for occupancy in March 1961.

The Hartford redevelopment area is situated between the commercial downtown section (Main Street) and the Connecticut River, with an excellent highway running along its bank—a perfect commercial location. Also, it is within the shadow of the Travelers Tower, a prominent landmark in Hartford. This project, uniquely, was planned to be entirely commercial, with no housing or industrial structures.

Early growth unplanned

Very few cities in the United States were planned; most just grew within topographical and man-made limitations. In the case of Hartford, the city is bounded by the river as well as by railroad lines and hills. Within these restrictions the commercial section of the city was built, followed by the civic district and then the first hotels. Closely related to these boundaries was the development of industry, which spread out from the waterways and railroads, almost invariably in undesirable patterns.

The area that is now Constitution Plaza had deteriorated to the point where it was a community disgrace. With the building of new bridges and superhighways, this area had become the gateway to Hartford, the insurance capital of the world. It was only natural that it should be designated as the city's (and the state's) first redevelopment project. The primary reason was to cure the abuses so typical of urban decay—the disproportionate cost of

The roof and sectional floors of Broadcast House at Constitution Plaza in Hartford, Conn., are being raised as complete units.

public services, the delinquencies, the tax losses and the like. The second reason was to give the new gateway an appearance worthy of the city's stature. At the same time the project could serve as the "seed pearl" for other redevelopment projects in the city.

A competent redeveloper will want to study an area—and a community—for at least six months before the land is ready for disposition. Time is needed for basic planning, for feasibility and economic studies, and for the preparation of the architectural layout as well as to contact prospective tenants, secure financing, and resolve other smaller problems. Hartford selected its redeveloper in a way that assured the best terms for the city and was fair to the firms that were spending a great deal of time and money in competing for the job. Four competent redevelopers were selected early. They were told that the job would be awarded to one of the four on a negotiated basis on the best proposition offered to the city. The aspirants were given all available information and knew that they did not run the risk of competition with unqualified promoters who might not take into consideration even the most basic economic principles.

Negotiations for the Hartford project were carried on quite openly; there were public hearings, inspections, appraisals and reuse appraisals. In all this there has been almost no public criticism.

Publicity given to a few shady deals in other cities has convinced a large segment of the public that urban renewal programs are set up for the enrichment of developers. These programs have become associated in many minds with tremendous subsidies at the expense of the taxpayers, as the public does not realize that such subsidies apply only to land acquisition and go largely to the city rather than to the redeveloper. Actually, according to HHFA estimates, for every dollar of federal money advanced for a project, somewhere between three and five dollars of private money is pledged.

The redevelopment problem for Hartford's east side was approached on the premise that concentration would be maintained, along with its advantages of convenience, competition, exchange and other characteristics so necessary to the survival of a business community. However, congestion had to be eliminated so that the newly created concentration could thrive in a healthy atmosphere. Admittedly this is a simplification of a very complex matter, but for Hartford's Constitution Plaza—a $50-million project—it was basic.

The McGraw Company was selected as Hartford's redeveloper in July 1958. In the ensuing months three major commercial tenants—the two leading banks and a radio-television broadcasting company—negotiated for space. There was no doubt then that Constitution Plaza, with its proposed office buildings, hotel, broadcasting center, retail commercial section anl large parking areas would be a success and would prove to be a catalyst for Hartford's future development.

Financial trouble

When leasing negotiations with three major tenants had been brought to a successful conclusion in the summer of 1959, plans were made to break ground in the late fall. By then all demolition would be completed and the City of Hartford could deed the land to the redeveloper. It was at this time that seemingly insurmountable difficulties developed in regard to the major financing of the over-all project.

The entire nation was in the grip of a tight money market. Although continuous discussions had been carried on with financial institutions and although prominent tenants had already made commitments for large segments of the area, one having taken an entire building, the available mortgage commitments were disproportionate to the needs of the project. There was no problem about getting money to finance individual buildings that could be erected soon. The difficulty was to get commitments for the long-range future for all the structures in the project. This was necessary to permit excavation of the entire redevelopment area at one time and to provide for the planned underground parking.

Up to this time, the McGraw Company had already invested about $700,000 in developing the project. A good-faith deposit of $250,000 had been left with the city. Obviously we had a lot at stake. Cost of the land had been agreed upon—$2,850,000—and we were prepared to break ground the day following consummation of the sale. Recognizing the nature of the financial difficulty, the city allowed as much additional time as was reasonable.

With every possible financial lead exhausted, consistent with the economics of the overall project, and a new deadline approaching, the Travelers Insurance Company, which has its home office in Hartford, made a proposition to the City of Hartford and to the McGraw Company. They would finance the entire project provided control was vested in a subsidiary company which they would set up. McGraw would retain an equity interest commensurate with its development costs and would be given a contract for construction. The plan was enthusiastically accepted both by the city and by the McGraw Company.

Ground was broken early in 1960 for the broadcasting facility, which will be the first structure completed. Work on the remainder of the project was started early in the summer and is moving rapidly. Work on the five-story Broadcast House is expected to be completed in March 1961. The Phoenix Mutual Life Insurance Company will erect its own building on adjacent land. McGraw has started construction of the Hartford National Bank Building and the Connecticut Bank and Trust Company Building as well as excavation for the entire site in preparation for construction of the garage under Constitution Plaza.

A community project

A vital role was played by many outside the redeveloper's staff. In addition to city planners, city officials, and federal agencies, other participation is required. In Hartford excellent cooperative effort and community spirit have come from the redevelopment agency, the newspapers, civic organizations, and most important, the average citizen.

Hartford's redevelopment agency, composed of responsible business and professional men in the community, is outstanding. It is an autonomous group that is directly responsible to the city government through its executive director, to the Housing and Home Finance Administration, and to state agencies. Channels of communication are always clear and decisions are given promptly.

It is worth repeating that a competent redeveloper is something new in this urban society of ours. He is a gambler dealing in huge stakes—something not uncommon in the construction industry. He must be more than a realtor and he must combine and correlate many areas of endeavor—financing, management, engineering, architecture, the law, public relations, and city planning. He must be an expert in tax matters to cope adequately with the ramifications of Title 1 and the local and state enabling acts.

The redevelopment field presents a tremendous professional, business, and human challenge to the enterprising contractor. There are problems foreign to construction that may seem nearly insurmountable, and we hope that from our "blood, sweat and tears" in Hartford other contractor firms may benefit. But there is a sense of satisfaction and pride of accomplishment to be found in doing something big for any city. And there probably will be a profit; we would not be in the redevelopment business if there were not good prospects for success.

CIVIL ENGINEERING

Thirty years of engineered progress

HAL W. HUNT, F. ASCE, Editor, CIVIL ENGINEERING, New York, N. Y.

The thirty years during which CIVIL ENGINEERING has been in existence, starting with the October 1930 issue, have witnessed amazing changes. These years have seen our greatest depression, our greatest war, our greatest prosperity, the development of the atom, and a complete change in our ideas of time, travel and space. The world is now experiencing the greatest engineered-construction boom of all time. In this country the concentrated work on the Interstate Highways is overshadowed only by building construction of all kinds.

One small statistic in the building picture is the United Engineering Center, which has been promoted, nurtured and to some extent developed through the pages of CIVIL ENGINEERING. The Member Gifts drive of ASCE for the building has reached its assigned quota of $800,000. The campaign is continuing to give all an opportunity to have a part in this structure and to provide a cushion for possible shrinkage below the amounts pledged.

Building for the future

Engineers have built for the future and have had it catch up with them before their projects were completed—let alone paid for. We have built individual roads and networks that were to be good for long periods of time only to find that, instead of solving a traffic problem, they were generating more traffic.

The thirty years of CIVIL ENGINEERING have seen the phenomenal rise of air, bus, truck, and waterway transportation—and a serious decline in the volume of railroad traffic. Commercial aviation, with its manufacturing plants, hangars, terminals and huge surfaced areas all over the world, has developed in the short period since CIVIL ENGINEERNG came on the scene.

Nuclear fission and the development of the atom for military and peaceful uses have added a complete new field to engineering since 1941. Long-range missile launching and the development of space vehicles constitute a challenging new field of civil engineering.

Aluminum has pioneered in developing a new field for light metals and has introduced new design concepts. When rolled in conventional steel shapes for use in structures it proved successful but uneconomical and emphasis shifted to shapes that would better utilize the special properties of the metal. Use of aluminum for building trim stimulated interest in other materials, and resulted in the use of stainless steel and other metals. The color and form of our current architecture resulted.

The thirty years of CIVIL ENGINEERING have witnessed a great change in methods of metal fastening. In 1930 welding was in its infancy, but the building of cargo ships for World War II—much of it by construction contractors—forced welding to develop to meet the shortage of experienced riveters. More recently, high-strength bolts have been replacing both riveting and welding for strength and economy. Workmen can be trained to properly install bolts much more quickly than they can be taught riveting or welding techniques.

Progress in construction equipment

As for construction equipment, in 1930 trucks were just beginning to replace rail dump cars for heavy earth moving, and pneumatic tires for trucks were gaining widespread use. Gas engines had partially replaced steam on heavy construction equipment before the advent of CIVIL ENGINEERING. During the early 1930's diesel power took over this job for heavy-duty work from both steam and gas. Carrying scrapers and rubber-tired tractors were developments of the early thirties.

The "Century of Progress" World's Fair took place in Chicago in 1933, and in June of that year an ASCE Convention was held in Chicago. Papers from that convention, featuring a hundred years of engineering, were reported in the August 1933 issue of CIVIL ENGINEERING. Many who attended this convention will remember the Skyway which was a big feature of the Chicago Fair—also the opening of the Lakes-to-Gulf section of the Inland Waterway, which connects Chicago with the Mississippi by way of the Illinois River.

The Tennessee Valley Authority was authorized in 1933. The first concrete was placed in Hoover (Boulder) Dam on June 8 of that year. Many of the great dams of the West were started in the thirties. The first connection of the word "mechanics" with soils appeared in December 1933. Prestressing for other than pipe or tanks was virtually unknown until the late 1940's. The use of plastics in civil engineering is a development of the past three decades.

One subject that often comes up in the old volumes of CIVIL ENGINEERING is featured in the current issue of October 1960. This is the obsolescence of the downtown areas of cities and how to deal with the related problem of slum areas. The problems of rebuilding the obsolete centers of old cities to provide beauty, usefulness, and a higher tax return from the property is a complicated one. That this was a relatively new field in the early thirties is indicated by the following remarks of the late W. W. Horner (ASCE President in 1946), in opening an ASCE meeting at St. Louis in October 1930:

Problems of a large city

"It is becoming clearer each day that the story of the town is about at the end of a chapter. The city of the late 1880's was not greatly different in

The American Road Builders' 1930 Road Show featured equipment now no longer seen on construction in this country.

Front-end loaders for tractors were not known when "Civil Engineering" started. Tractors have become a universal tool.

structure from ancient Rome or Pompeii, but the city of tomorrow may easily be like nothing that ever was.

"We have had to invent a new agency, which we call city planning, and have complacently assigned these matters to it. Today it appears to be crying for help, handicapped by having to keep one hand on the holes in the bursting wall of the old city while the other attempts to shape the outer terrain. It is evident that city planning, joined with organized business, has had to devote its efforts primarily to retard the too rapid change, if not dissolution, of the older city. But it may be able to do no more than avoid cataclysmic revision. It will be especially interesting to see whether the rural district, which has been giving up its people so freely to the city, is about to receive them back with bits of the city sticking to them."

The late E. R. Kinsey, M. ASCE, speaking at the same session, commented:

"It is a common experience to find in American cities, sections that once were valuable, which have deteriorated because the avenues of approach became congested. Land without accessibility is valueless. Enormous waste in land values occurs in those localities where existing transportation facilities have become inadequate. . . .

"It is good engineering to promote and conserve the health, comfort, convenience, happiness and morale of the people. A well planned city is prepared to expand such facilities as pure water, good sanitation, enough light and air and recreational projects as its growth may require. It is neither good business nor good engineering to plan an ugly city, however well utilitarian requirements may have been met. An ugly public square is a reflection on the good taste of the entire community."

At the recent ASCE convention in Reno (CIVIL ENGINEERING, August 1960, p. 61) a report on a Congressional investigation stated:

"Intensity of the controversy on the Reno-Sparks route selection is unfortunate evidence of what can happen if local bodies and the public have not received ample advance briefing. Notwithstanding that there has been technical compliance with the statutory requirements, in the opinion of the subcommittee, much of the Reno difficulty could have been avoided if more attention had been accorded by the state to the matter of public information."

These highway planners might have profited from comments of the late A. P. Greensfelder, M. ASCE, made at the 1930 St. Louis meeting (CIVIL ENGINEERING, January 1931, p. 271):

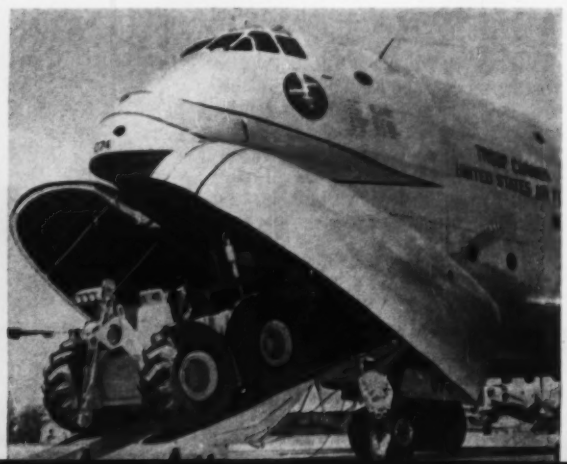
"If planners would hold more meetings and hearings before preparation of a plan, rather than afterwards, they would very probably progress faster and further than they do now and might meet with less opposition and discouragement."

Some things, including cost of paving and of engineering, were different then. To quote Mr. Greensfelder further:

"By coordinating comprehensive highway plans covering each county and city in a region, the major highways can be properly connected to ensure continuity with uniform widths. Such plans will serve to guide simultaneous construction of main arteries by the various public authorities and thus hasten the opening of through 'region ways.' They will also permit the local allocation of funds from year to year. With hard pavement costing

Tractor-drawn elevating grader loads material for long haul. Carrying scrapers are more economical for short haul.

World War II accelerated development of compact, powerful construction machines. Some of them were air-dropped.



Grand Coulee Dam on the Columbia River in central Washington, largest man-made masonry structure, built 1933 to 1942.

Kill Van Kull Bridge, with the longest (1,652-ft) arch span in the world, was opened in 1931 in the New York-New Jersey area.

$40,000 a mile, the saving of half a mile by careful planning will more than pay for a whole county plan. . . . Recreation has until recently been a pastime only for children; its value to adults has been more or less only recently recognized. . . . There is a distinct relationship between misdemeanors and lack of playground facilities."

Today and thirty years ago

Interesting parallels can sometimes be drawn between present work and that of thirty years ago. On May 1, 1929, an area 150 ft by 200 ft in downtown Manhattan was covered with substantial buildings of brick and stone. One year later the old buildings were gone, the seventy-story Bank of Manhattan Company Building had replaced them, and its elevators were transporting tenants to offices. With the tower, the structure is 927 ft high. Currently a new Chase-Manhattan Bank building with a 60-story height is being completed nearby. Construction has taken longer, partly because of the excavation of basements which go down 85 ft, to 56 ft below sea level.

During the first year of CIVIL ENGINEERING's existence, the Empire State Building and the Chrysler Building in New York were completed, each of them on a site that had to be cleared of obsolete structures. A little later Rockefeller Center was built, a lucrative investment, but in that time of depression a gesture of faith in the future. The second issue of CIVIL ENGINEERING, November 1930, featured the just completed Cleveland Union Terminal, a true urban renewal project, which greatly improved the downtown area of that city.

Sanitary engineering advances

An article by the late Morris Knowles in CIVIL ENGINEERING for March 1931, p. 525, contained the following:

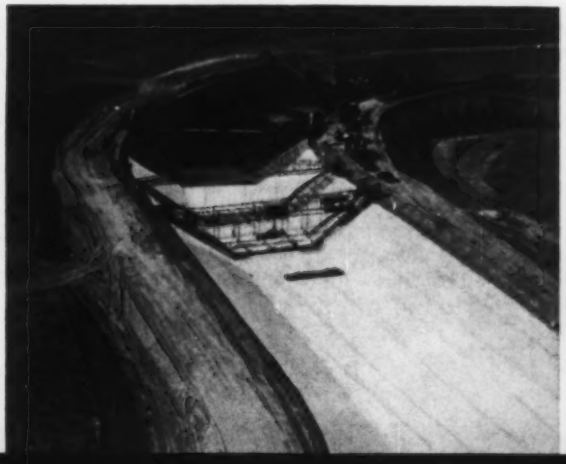
"The work of most civil engineers today has to do with building or rebuilding cities, or with bringing to city dwellers the things they want and need. . . . The term 'city planning' has given expression to the growing demand for national town planning with greater foresight, better coordination, and more attention to the community as a worthwhile place for living as well as for working. . . .

"In the field of sewage disposal particularly, the engineer has been guilty of recommending the very least degree of treatment compatible with the prevention of nuisance, instead of a complete process for the preservation, as far as possible, of original conditions in the streams. To reinforce such recommendations of incomplete measures he can call upon science, which has devised dilution factors and minimum oxygen requirements, but frequently he neglects esthetics, with its other standards which should also be met.

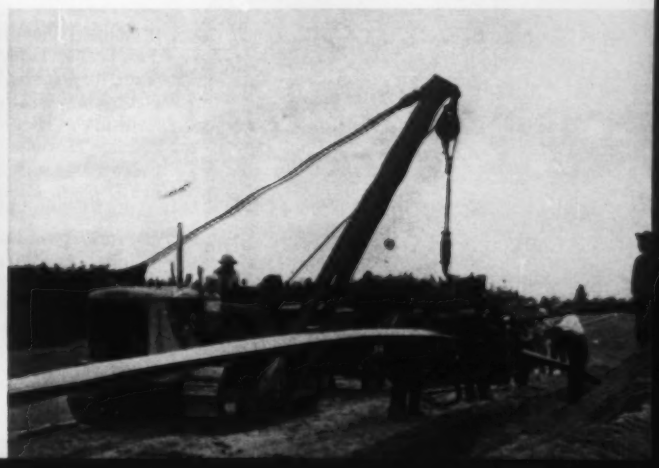
"No longer will the sole criterion be to meet the minimum sanitary requirements for preventing nuisance and lessening the danger to public health. In the future the demand will be for water courses so utilized and made available for development that they will become recreational units in the life of the countryside."

The Ohio River, with which Mr. Knowles was concerned during much of his life, became one of the first major streams to undergo substantial improvement. And the rebuilding of the "Golden Triangle" area of his home city of Pittsburgh is an outstanding example of the type of urban renewal featured in this issue.

Trains of equipment perform complete jobs—this time trimming, paving and finishing the concrete on an irrigation canal.



Transcontinental pipelines and side-boom tractors are relatively new. This machine cleans, wraps and coats the pipe.



AMERICAN SOCIETY OF CIVIL ENGINEERS FOUNDED 1852

THIRTY YEARS of ASCE

...in CIVIL ENGINEERING

EDITOR'S NOTE:

Among the many who have given their best efforts to CIVIL ENGINEERING in the course of its 30-year history are Ruth Campbell, Associate Editor, and Mary Jessup, News Editor, who have been on the staff since the first issue. They have worked on every issue, handling the routine of getting out the magazine as well as doing creative editing, writing and layout. These two capable people have worked with seven editors and have trained the changing younger staff of the magazine over much of that time. From this long association Miss Jessup has written this review.

The Society is indebted to Miss Campbell and Miss Jessup for much of the continuity and effectiveness of CIVIL ENGINEERING.

In its thirty years of existence CIVIL ENGINEERING has reported developments in ASCE and in the profession as significant—if not as startling—as the physical changes of the past three decades. Actually CIVIL ENGINEERING has done far more than record the development of the Society and the profession in the challenging 1930-1960 period. As a medium of communication for the Society, it has done much to foster the growth and improve the status of both ASCE and the profession.

CIVIL ENGINEERING was launched, in October 1930, on the eve of the most serious depression ever confronting the country. The first issue, a slim 68 pages, went to 14,366 Society members; the current issue of 172 pages goes to the present membership of 46,795 and a large number of non-member subscribers. The first issue carried eight pages of advertising—the first ads ever to appear in an ASCE publication.

Though ASCE is the oldest of the Founder Societies, it was—before October 1930—the only one of the societies without a professional monthly journal. CIVIL ENGINEERING was started in response to a long-felt need for an outlet for the Society's professional interests and activities and to supplement the Technical Publications that had been in existence since 1872 and the early days of the Society.

In the decade before CIVIL ENGINEERING was launched, studies made by the Committee on Development and the Committee on Aims and Activities had come to the conclusion that, "the Society was ready to become an active national force in economic, industrial, and civic affairs." In the late twenties a Functional Expansion Program was set up to help the Society in achieving its aims, "technical, professional, and administrative," and a professional journal of semi-popular nature seemed essential to the successful carrying out of the expansion program.

The Committee on Publications, under which CIVIL ENGINEERING was inaugurated, envisaged it as an aid "in promoting the objectives for which the Society has labored for nearly eighty years." Harrison P. Eddy headed the committee, with Morris Knowles, Malcolm Prinie, Ole Singstad, and Charles H. Stevens as members. J. F. Coleman, then President of the Society, hailed CIVIL ENGINEERING as "a great progressive step." George T. Seabury, as Secretary of the Society, and Sydney Wilmot, as Manager of Publications, put continuous effort into getting the new publication started, and Walter E. Jessup came from Los Angeles to be the first editor.

The first issue set a high standard. Elwood Mead, Commissioner of Reclamation, wrote on Hoover Dam, one of the country's greatest and most dramatic reclamation projects, which was under construction in 1930. W. E. Wickenden, president of the Case School (now Institute) of Applied Science contributed a thoughtful article on the professional status of the engineer. Dr. Wickenden was the author of "The Second Mile," long required reading for young engineers.

In 1930 engineers were giving considerable thought to their professional status and to such prerequisites to professionalism as sound standards of engineering education and registration (then a highly controversial subject.) The registration of engineers, originally called "licensing," had been before the Board of Direction at various times since 1910. Similarly, the Society had from the first recognized the necessity of maintaining sound standards of education. However, it was not until CIVIL ENGINEERING came into existence that the Board of Direction and the various Society committees had an effective open forum for presenting their proposals in various areas to the membership.

From its first issue CIVIL ENGINEERING has strengthened the Society and the profession by making its members aware of what the Society is trying to do and by suggesting what individuals and groups can do to improve the status of the profession. Early in the 1930's, for instance, ASCE took measures to aid its many members who were hard hit by the depression. In the metropolitan area this aid took the form of cooperation with the other Founder Societies in the formation of a Professional Engineers' Committee on Unemployment. In its first year of operation this committee—brought to the attention of the membership and discussed in early issues of CIVIL ENGINEERING—was instrumental in placing 85 percent of the 240 civil engineers that registered with it. On a larger scale, ASCE was one of the first organizations to suggest a strong public works program as a sound means of alleviating the economic crisis. The Society's stand in the matter and correspondence with President Hoover were also reported in CIVIL ENGINEERING.

Since 1930 all matters, big and little, affecting the Society in any way have been brought to the attention of the

membership in the pages of CIVIL ENGINEERING. In the thirties, when engineers had more time on their hands, they wrote constructive letters to the editor in great number—sometimes forty or fifty of them a month. Two subjects they seemed to find particularly engrossing were the public domain (the pros and cons) and the Pan American Highway—was it or was it not a feasible project?

A development that CIVIL ENGINEERING has been especially pleased to report over the years has been the improving status and importance to the Society of younger engineers. As reported in the October 1930 issue, 2,323 Junior Members represented about 16 percent of the total membership of 14,366. They could not vote and could not hold office in the Society or Sections; they were rarely represented on committees and had little, if any, place in Section or national programs. The present 19,000 younger members, now designated "Associate Members," represent more than 40 percent of the Society's total membership.

It will be noted in the accompanying tabulation that in 1930 Members and Associate Members were "corporate members", which meant they could vote. A Constitution change in 1947 enfranchised the Junior Members; other recognition has given them an increased and active role in the Society.

Recognizing the growing potential and usefulness of this group, CIVIL ENGINEERING inaugurated a "Younger Viewpoint" department with the July 1958 issue. In 1959 the Junior Member grade was eliminated in favor of Associate Member in a general change in ASCE grade designations. This was one of the "causes" espoused most warmly in "The Younger Viewpoint." That this improved recognition has been valuable to the Society is attested by an increase of 10 percent in the number within the younger group in the past year while the other classes of membership had a 4 percent increase.

In the thirty years of CIVIL ENGINEERING, the Society has reached in many directions to increase the scope of its activities. Increasingly over the years it has been invited to cooperate with various branches of the Government and with units of the Armed Services in the interest of making the technical knowledge of its members more readily available to the nation. The Society's part in helping to form Engineers Joint Council in the postwar years is another case in point. Through EJC the various branches of engineering can act as a unit in legislative and other matters requiring a unified professional approach.

Similarly, CIVIL ENGINEERING has recorded increased ASCE participation in groups established to promote international good will through professional understanding. Two of the most important of these are the Conference of Societies of Western Europe and the United States (EUSEC) and the Pan American Federation of Engineering Societies (UPADI). On the technical level, there has been cooperation with many groups, such as the World Congress on Large Dams and the World Earthquake Engineering Conference.

More unity and professional solidarity at home is another long-time goal of the Society. To this end ASCE has at various times formed cooperative committees with such groups as the Associated General Contractors of America, the American Association of State Highway Officials, the American Institute of Architects, the American Institute of Consulting Engineers and the Consulting Engineers Council. Today professional achievement is promoted by ASCE cooperation with more than 100 national engineering organizations.

One of the Society's most dramatic and important cooperative efforts, of course, has been its part in the financing and building of the new United Engineering Center. When the Society completed raising its $800,000 share of the cost this past August, it brought to a close the largest single financing campaign in its history. In month-to-month stories over a period of several years CIVIL ENGINEERING has sought to sustain interest in the structure and in the fund-raising campaign.

The success of CIVIL ENGINEERING in stimulating the interest of engineers in ASCE led the Society to establish a public relations department to interest non-engineers in the profession. Some of the programs developed by the department—notably the "Seven Modern Civil Engineering Wonders" and the annual "Outstanding Civil Engineering Achievement Award"—have been extremely effective in making the lay public aware of the civil engineer's contribution to the American standard of living.

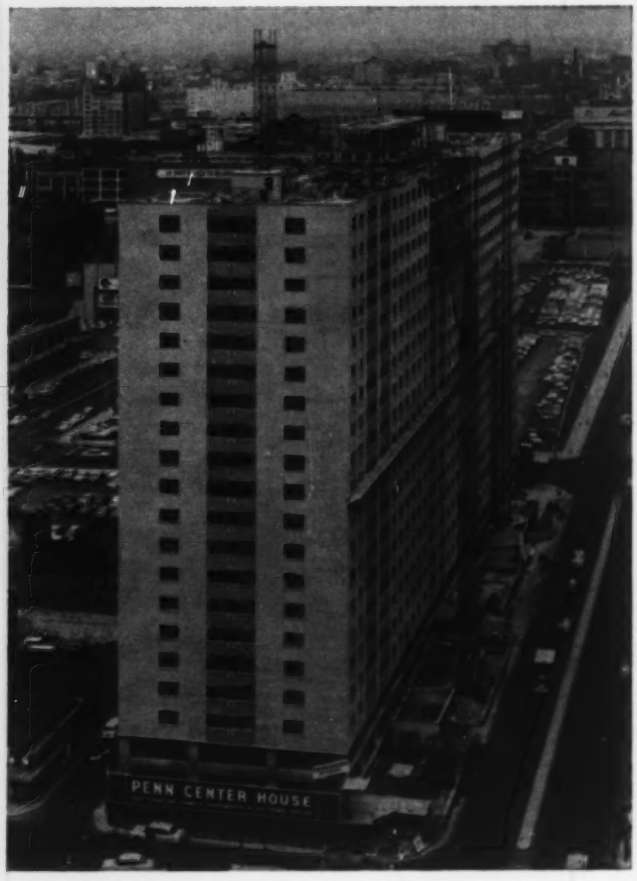
Of course these are but a few of the highlights in the Society's development. In the 360 issues spanning its existence CIVIL ENGINEERING has recorded the results of multitudinous studies and investigations in such areas as employment conditions, unionization, salaries, registration, engineering education, research, to mention a few. It has reported technical improvements wrought by Society committees in column analysis, in reinforced concrete, in railroad design, in pipeline planning, and in a score of other active fields.

In addition to keeping members abreast of technical and professional developments, CIVIL ENGINEERING has done a great deal of run-of-mill reporting. It has brought members news of Society, Technical Division, and Local Section meetings; has told them of job changes in their number; has published notes on recent technical books and literature; has apprised them of job opportunities; has brought monthly word of the Washington scene; has listed all new members; has published obituaries of all deceased members; and in its advertising pages has described the machines, materials, and processes that help the engineer on the job.

Inevitably CIVIL ENGINEERING has nurtured the Society's growing consciousness of its responsibilities in directions and areas undreamed of thirty years ago. This, needless to say, it could not have done without the generous help of the members who have contributed some 4,000 articles to CIVIL ENGINEERING telling of their projects all over the world, of their studies, and of their researches.

ASCE MEMBERSHIP AS OF SEPTEMBER 10, 1930		ASCE MEMBERSHIP AS OF SEPTEMBER 9, 1960	
Members	5,764		
Associate Members	6,115		
Corporate Members	11,879	Fellows	11,218
Honorary Members	17	Members	16,249
Juniors	2,323	Associate Members	19,178
Affiliates	146	Affiliates	102
Fellows	7	Honorary Members	47
Total	14,366	Total	46,794
		(Sept. 9, 1959	44,064)

PENN CENTER HOUSE



HAROLD H. GEBERT,

A one-hundred-million-dollar example of what can be done to rebuild the heart of a city is Penn Center in Philadelphia. A new addition to this center has almost been completed—a 432-unit cooperative apartment house, the largest such structure financed by the Federal Housing Administration. Known as Penn Center House, it forms part of the urban rebuilding program for central Philadelphia, made possible by the moving of the old Broad Street Station and the railroad tracks that ran into it on what was long known as the "Chinese Wall."

Penn Center House is the sixth major new building in Penn Center. Already in use is the Pennsylvania Railroad Suburban Station Building, a multi-story structure with offices built over the relocated suburban railroad terminal. Next came No. 2 Penn Center and No. 3 Penn Center, office buildings on the site of the old Broad Street Station. A full block is occupied by the Transportation Center with its high office-building structure, its three-story garage and Greyhound Terminal. Just across the street is the new Sheraton Hotel.

These buildings and those to come will occupy less than 50 per cent of

AT CENTER: Heavy bars extending down into the caissons tie the columns into the foundation to resist uplift in the narrow structure.

AT FAR RIGHT: The boom of the Towercrane was raised to pivot at 130 ft above the street to reach over the high floors of the building.

Slab is being concreted at ground level.▶

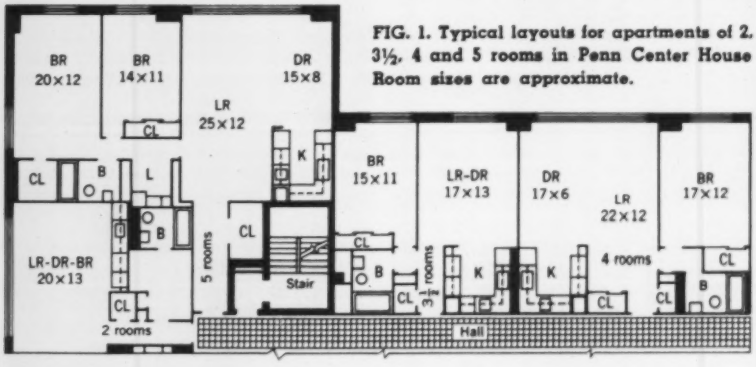


FIG. 1. Typical layouts for apartments of 2, 3½, 4 and 5 rooms in Penn Center House Room sizes are approximate.

in a city renewal project

Vice President, R. M. Shoemaker Company, Philadelphia, Pa.

the area. The problem of motor transport is partly handled by an underground street, with loading docks for delivery to Penn Center buildings at basement level. The same solution was applied to the Greyhound Terminal; buses go underground to the passenger loading and unloading level.

Penn Center has been more than thirty years in the making. The first plans for its development date back to 1923, when a fire in the Broad Street Station gave some civic-minded Philadelphians the idea of moving the old station and the railroad approaches to it and making the space available for modernizing the city's crowded center. The depression of the early thirties and World War II in the early forties delayed this urban rebuilding but it is now well under way, with additional structures planned for construction.

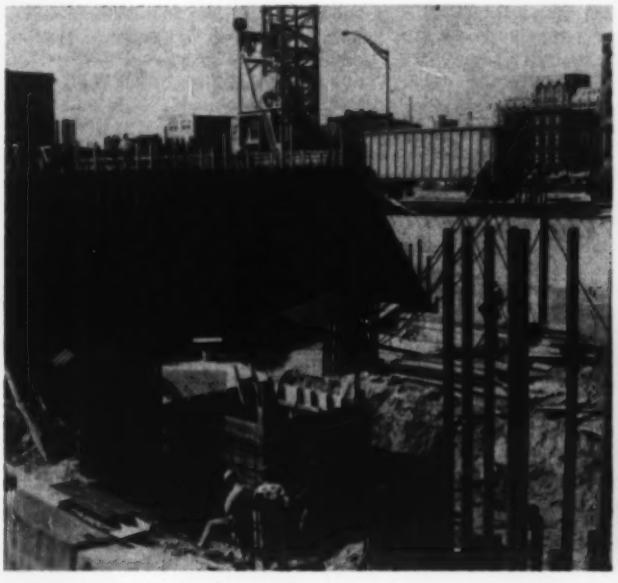
Penn Center House is the first apartment building in the area but it has been so successfully financed and quickly sold that another is contemplated. Besides being the largest cooperative apartment house ever financed through the FHA, the new structure is distinctive in other ways. Despite expensive foundations, the 20-story, 397 x 72-ft, all-concrete building was economically constructed for a total investment, including land in the heart of Philadelphia, of $7.2 million. The building has few frills but all essentials, including through-the-wall air conditioning units in every outside room. There is a lot of glass to make the apartments light and airy. The exterior brick wall is 4 in. thick and there is a 2-in. cavity and 4-in. concrete block backup to complete the wall. Floors are 7½-in. poured-concrete flat slabs with no "drops" except spandrel beams. Columns are the same size from top to bottom to permit economical formwork as well as a single location plan for all appliances, cabinets and bathroom fixtures. Stronger concrete in the columns for the lower floors helps to make this economical.

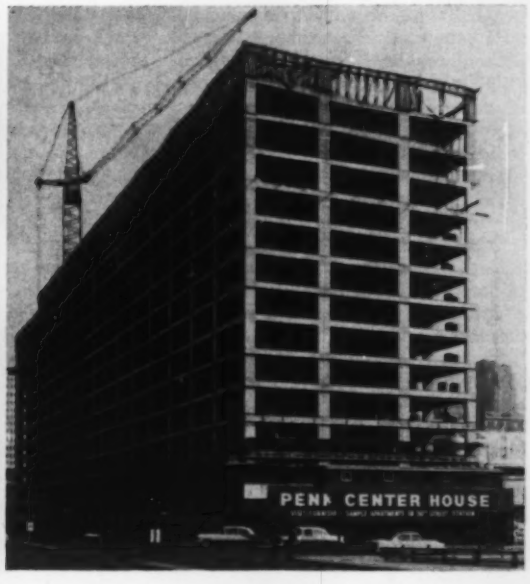
Below the Chinese Wall

Foundations for Penn Center House were troublesome. Column loads for the structure range from 2,200 kips for a few columns with heavy wind loading, through 1,200 kips for general building loads, down to some small loads for a two-story section. The structure is built on the site where massive masonry walls had held the embankment on which the trains ran into the old Broad Street Station near City Hall. Above-ground parts of the embankment were removed a few years ago.

Caissons were selected to carry the loads to rock at depths varying from 19 ft to 63 ft. The original plans called for belling out the caissons at the surface of moderately hard rock to keep the loading to around 30 tons per sq ft with a permissible maximum of about 40 tons per sq ft. The foundation contractor asked permission to make the caisson shafts full size all the way down instead of belling them out at the bottom—with the exception of a few caissons. The size ranged from 36 to 72 in. but most of the caissons were in the 56-in. to 66-in. range. The holes were augered and followed down by steel casing, in sections, to provide a cased hole that was practically dry and could be visually inspected. Holes penetrated from 3 to 12 ft into the rock, depending on its visual appearance and on a system of rock testing utilizing hand-held drills.

The engineers, working with a local material testing laboratory, established through lab tests that an acceptable 40-ton rock was reached with a factor of safety of 2½, when a new 1½-in. diamond drill, using an air pressure of 100 psi, and with the operator leaning





on the 75-lb air hammer, made a penetration of not more than 8½ in. in one minute. Three drill tests were made under supervision and an average penetration was taken. If the tests were unacceptable, the excavating contractor had a choice of belling out to a prearranged larger bearing area or continuing the caisson until firmer rock was encountered. No credit was given to rock sockets and no allowance was made for the well-known fact that the bearing value of rock in its native bed had a much higher bearing power than a core sample that was removed and tested.

Concrete of 3,000-psi quality was discharged into the hole directly from transit-mix trucks. (Some caisson caps were of 5,000-psi strength to match the column concrete above.) The steel shell of the caisson was withdrawn as concrete was placed; a few pieces of the casing were left in the ground where they had become wedged, as it would have cost more to remove them than they were worth.

The basement and first two floors of the structure are arranged to provide 238 parking places, or about one car for each two apartments. The garage area was designed for a 75-psf floor load. Wood forms were built in place to carry the concrete slab, which was warped in some areas for ramps.

The long building is divided by expansion joints into three sections. Because of its narrow width, special shear walls are necessary. In the center section, shear is resisted by the concrete walls of the elevator shaft and stairwell. Two 8-in. reinforced cross-walls, extending to the top of the structure, take the shear of each wing.

The structure was designed for a floor live load of 40 psf in the apartments, 100 psf in public areas, and 30 psf on the roof. The ultimate-strength method was used for column design with the rest of the structure planned according to elastic design procedure. Rail steel was used in the columns at a design yield strength of 50,000 psi and intermediate steel at a 40,000-psi yield strength in slabs and the like.

Tower crane for concrete

A Universal-Liebherr Towercrane, an import from West Germany, was used for hoisting the concrete, moving the forms and handling other materials of construction. This electric-powered crane has a vertical tower mounted on the usual rotating bed frame, in this case moved on rails. The boom is hinged high up on the tower so that it can reach over a structure to permit spotting loads at some distance horizontally. The tower is built so that it can be extended as the structure rises to permit swing of the boom. This building was ideal in size and shape for the use of the Towercrane. Its width is such that the boom could reach the whole structure, and there was enough work that could be handled from one set-up to make it economical to lay a firm track and set up the rig.

The crane traveled the 400-ft length of the building on rails of 15-ft gage, and its 105-ft boom could reach even remote corners of the structure. For the lower floors, the rig was used with the pivot point of the boom at 79 ft 6 in. above the rails. For the upper floors the tower was raised so that the boom pin was 130 ft above the ground. With this arrangement, concrete and other materials were placed directly where needed for all floors up to the 15th. On the five top floors it was necessary to wheel concrete to the far side of the building.

The operator sits at the pivot level, in this case 79 or 130 ft above the rails, where he can spot the load visually rather than through a signalman. Incidentally, it took a little time for operators to become used to the swing and sway of the flexible tower and to learn to avoid rapid starting and stopping of the swing; some operators did not stay with the job.

A single set of wall, column and spandrel forms was used, with two sets of slab forms, for the 18 apartment floors. The column forms were accurately made in a shop, and built sufficiently rigid to withstand being used 20 times to complete the structure within ¼ in. of plumb. The slab forms were supported on wood shores, wedged up to give a camber of ⅛ in. in 5 ft in the center area between columns. Each piece of plywood was carefully marked for its position in the structure and was reset each time in exactly the same position for successive floors. On the plywood, locations of inserts for pull-boxes and pipe openings were marked accurately, and the reinforcing steel needed was indicated. This resulted in fast and easy placing of material and permitted rapid checking of an entire floor.

Each floor required about 600 cu yd of concrete. The 25,000-sq ft area was formed and concrete placed in five sections on successive days. Thus the building could rise at the rate of one floor a week. Column, wall and spandrel forms were stripped the day after concreting and raised to position for the next floor. The two sets of slab forms made it possible to leave these supports in place for several days while the concrete gained strength. The form sections were carefully removed and carried by hand to temporary platforms at the periphery of the building, where the crane hoisted them to their next position. The plywood was coated with plastic at the start of the work and, with minor touch-ups, was satisfactory for the ten to twenty uses required.

Again, concrete was delivered in transit-mix trucks and discharged directly into a light-weight bottom-dump bucket for hoisting by the crane. A full cubic yard could be handled with the crane boom on a moderate radius but the load was reduced for placing at a distance from the center of swing. An admixture, Sonotard, was used in the concrete to give improved strength and workability and slow initial set for easier finishing.

The slab surface was steel troweled in preparation for an asphalt-tile floor. The under side was carborundum-rubbed to eliminate noticeable irregularities; this was done by a "giraffe," the job name for a power-driven unit that was moved around on wheels while an extendable arm held the rubbing block against the ceiling.

Walls between apartments and around baths are of 4-in. cinder block, plastered on both sides. Walls within an apartment are 2-in. solid plaster, which was supported temporarily until plaster could be applied on both sides. Plaster is mixed at the ground-floor level and pumped all the way up through a 2-in. pipe and hose. For the upper floors, a booster pump is set up. The brown or scratch coat is sprayed directly on the walls and struck off with a wood screed. The white surface coat is pumped up to tubs on each floor and applied by hand in the conventional manner.

The cooperative apartments in the Penn Center House are finished with paint and trim as wanted by the owner. Appliances are furnished installed and include a refrigerator, electric stove with separate oven, dish-washer and a washer-dryer. Cabinets are built in and asphalt tile is laid in all rooms. Baseboard steam heat is provided along all exterior walls. The air-conditioning units are individual for each room and are designed to be easily removable so that if a unit fails to function, it can be replaced in minutes.

Ninety per cent of the apartments had to be sold before FHA financing could be completed and construction started. The public was attracted by advertising and sold from sample apartments set up in the Thirtieth Street Station of the Pennsylvania Railroad.

The architect for Penn Center House is George S. Idell. The structural engineers are Allabach and Rennis, Inc. Robert G. Hoffer Co. erected the concrete frame, and R. M. Shoemaker Co. is the general contractor.

Integrated improvements for Chattanooga

ROBERT E. BARKLEY, M. ASCE, Executive Director, Development Commission of Greensboro, N. C.
Formerly Urban Renewal Coordinator, Chattanooga, Tenn.

A freeway and a large amount of land leveling are major elements of the 403-acre West Side Urban Renewal Project in Chattanooga, Tenn. The project offers an excellent example of economies achieved through coordination of public works programs. Chattanooga has interrelated slum clearance with downtown freeway construction, utility expansion, and community facilities fringed by light industry. The total cost of this work will be considerably less than that estimated for these programs if they had been undertaken separately. The savings are due solely to careful project planning and imaginative engineering studies.

The West Side Project is adjacent to the central business district, and is bounded by the Tennessee River and a district devoted to heavy industry. This section of Chattanooga developed at an early date because of a natural boat landing on the river. The flood plain in the vicinity of the landing was developed for industry and worker housing, while the higher area became the fashionable section of the city. Over a period of years, however, the fashionable homes were converted into apartments and rooming houses.

A detailed analysis of housing and environmental conditions within the West Side Project revealed that practically all the structures were seriously deteriorated, lacking in basic facilities for healthful living, functionally obsolete and placed on lots of inadequate size. Of the 2,940 dwelling units in the project, 80 percent were substandard. The existing street pattern was discontinuous and rights-of-way were extremely narrow in all but a few cases. The urban renewal area was lacking in community facilities since only four small recreational areas served the 1,960 families residing in the section. In much of the West Side, commercial and industrial uses were intermixed with residential structures, to the detriment of both types of use. Some sections had inadequate utility services, although this was not a major problem.

Preliminary reconnaissance of the project area made it evident that many types of problems would be encountered in the clearance of 403 acres in the heart of the city. The Chattanooga Housing Authority considered it essential to maintain over-all control of the planning of the project, but to utilize specialized services in solving technical problems. Adequate base maps were obtained by photogrammetry; topographic maps were prepared to a scale of 1 in. equals 40 ft, with 2-ft contour intervals.

Proposed land uses analyzed

Market analysts were employed to assist in the delineation of proposed land uses and in determining the economic feasibility of the urban renewal project. A site planner was retained to formulate the street pattern and a plan of redevelopment. A firm of civil engineers assisted the Housing Authority in the preparation of utility plans, grading schemes, and other site improvements. The combined services of these consultants has resulted in a program that is unique from an engineering standpoint and a significant contribution to urban renewal.

Topography was a major factor influencing the redevelopment of the project. The flood plain along the Tennessee River has an elevation of 650, and the central business district is only slightly higher. Within the project area there are four hills, the highest of which has an elevation of 973. These hills had profoundly affected the past development of the West Side, creating many discontinuities in the street pattern and making much land unusable for development. Although the project is in the center of Chattanooga, almost one-fifth of the total land area had not been built on, primarily because of topography. Project planning and preliminary engineering made it evident that considerable grading would be necessary to effectuate a desirable reuse plan.

Reuse planning required careful coordination with the location and design of a projected freeway. At the inception of the urban renewal project, the route and tentative geometrics of the freeway had been established by the Tennessee Highway Department. The freeway traverses the entire length of the urban renewal project, and serves as a spur from the Interstate System to a connection with U. S. Route 27 north of Chattanooga. It has been located so as to form a buffer between the central business district and the residential areas projected as part of the urban renewal plan.

The freeway, which runs in a north-south direction, provides three major interchanges with intersecting streets serving the downtown section and the urban renewal area. This major highway has enhanced the marketability of land in the West Side area, while street revisions accomplished through urban renewal have improved the accessibility of the freeway.

Construction of the entire freeway system in Chattanooga will require more than 6,500,000 cu yd of borrow. These fills will raise the freeway above flood stages of the Tennessee River and will permit overpassing of existing streets. Before the urban renewal project was started, the Tennessee Highway Department planned to dredge embankment material from the Tennessee River, stockpile the material to drain and consolidate, and then haul it to fill sections. Need for regrading parts of the renewal area led to a consideration of the hills as an alternative source of borrow. The dredged material would not have to be hauled as far as material excavated from the four hills, but would require considerably more handling and the acquisition of a diked storage area. Cost comparisons clearly showed that borrow material obtained from the West Side would be the cheaper source. Soil investigations clearly indicated that a cut of 160 ft on the highest hill was entirely feasible.

Grading of the hills will not only permit a considerable improvement in the street pattern, but also will increase the amount of buildable land. Regrading of the largest hill, which will require a cut of 160 ft, will increase the amount of usable land from 12 to 28 acres. The hills will still afford commanding views of the city and the river, and the area will be highly desirable as an in-town neighborhood.

About 1,150 families will be rehoused in garden apartments and town houses, at densities ranging from 18 to 20 families per acre. Another 230 families will

be rehoused in high-rise apartments, having a net density of about 40 families per acre. School, community and shopping facilities will complement the residential uses and effect a stable balance of facilities within the area.

Unsuitable bank slopes and ravines will be left in their natural state. They will serve as effective buffers against other land uses surrounding the hills. Several other public park areas are included in the plan—a neighborhood park at the summit of the largest hill, and a river-front park complete with a marina.

The freeway right-of-way requires approximately 63 acres within the West Side project. About 70 acres will be utilized for residential purposes. The distribution of the existing and proposed land uses outside the freeway is shown in Table I.

TABLE I. Allocation of land uses within West Side Project

Exclusive of 63 acres of freeway right-of-way

Type of Use	Existing Acreage	Proposed Acreage
Streets, alleys, railroads	67.15	39.08
Residential	122.88	69.63
Public or semi-public	13.52	81.03
Unimproved or open land	63.26	0
Commercial	15.47	35.71
Industrial	44.49	102.45
Institutional or semi-public	13.29	12.16
Total	340.06	340.06

The area grading will permit a more efficient street pattern and a reduction in street rights-of-way from 67 to 39 acres. The amount of land for public or semi-public uses will be increased six times, thus maintaining the stability of this in-town neighborhood.

Major public improvements

The urban renewal plan for the West Side will accomplish a number of other major public works improvements. A major street will be constructed parallel to, but at some distance from the Tennessee River. This street will not only improve traffic circulation within the central area of Chattanooga but will also provide good access to sites of heavy industry along the Tennessee River. A major east-west street, which now comes to a dead end within the project, will be extended to connect with the river-front drive.

The local street pattern has been designed to facilitate access to abutting property, while discouraging a heavy flow of through traffic. This dual aim presented a difficult design problem in the central area of a city. The reshaping of the hills permitted the design of a local street system with only one grade of 11.5 percent. Average maximum grades will be about 8 percent, whereas grades of 20 percent or more are not uncommon on the existing streets.

Many administrative and engineering problems have had to be resolved to realize the urban renewal plan. Right-of-way for a part of the expressway through the West Side was acquired before the urban renewal project was started. To avoid double negotiations and claims for severance damages, severed parcels were acquired in their entirety. This was contrary to customary Highway Department practice, but was accomplished at a great saving in cost. The total acquisition cost of each parcel was then prorated between the two agencies on the basis of the relative land area in each project.

Acquisition and clearance of borrow areas have been closely coordinated with freeway construction. The section of the freeway thus far built through the renewal area required about 300,000 cu yd of borrow excavation. This borrow has been obtained from the smallest hill in the project area. Another section of the freeway, now under contract, will require the material remaining in this hill. The site will then be ready for the expansion of high school recreational facilities.

Since borrow will have to be hauled a maximum distance of four miles, transportation to the expressway embankments constitutes a major problem. A desirable objective would be to eliminate all borrow haul on city streets so as to minimize delays to traffic and eliminate wear and tear on pavements. The Tennessee Highway Department will accomplish this goal largely through the construction of private haul roads over freeway right-of-way.

As shown in Table II, substantial public works activity will result from the urban renewal program. Site improvements will total about $4,962,000, exclusive of land but including engineering and contingencies. Table II does not include funds spent by the State Highway Department for the freeway and access street construction or costs of grading included in the borrow areas. The grading costs listed in Table II are those to be incurred by the Chattanooga Housing Authority in preparing land for resale. Coordination of the freeway and urban renewal pro-

View of completed segment of freeway shows bridge across Tennessee River. This bridge has second largest deck girder span in the United States.

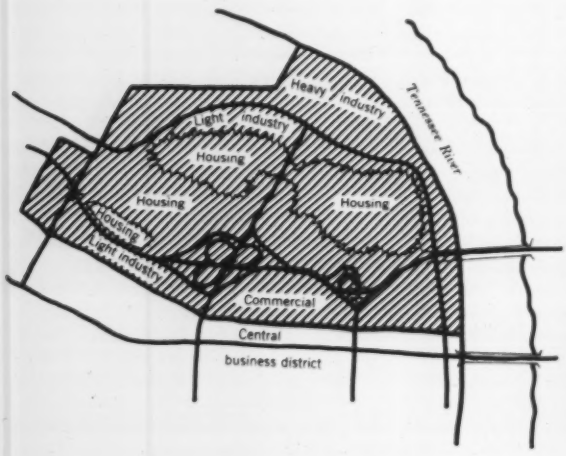
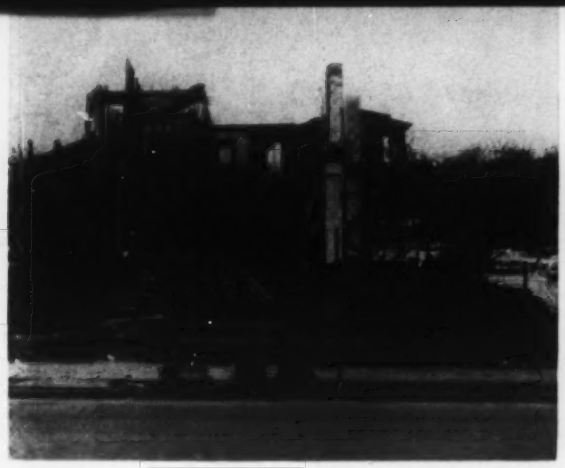
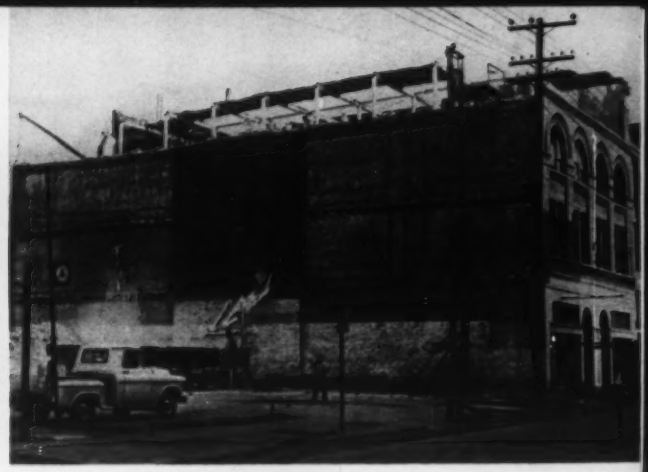


FIG. 1. Road pattern ties this plan of Chattanooga's West Side Urban Renewal Project to photo above. Only major roads are shown. Squiggly lines show major hills.



An obsolete apartment house is demolished. Cleared land in background is leased temporarily for off-street parking.



Old commercial buildings are being demolished—within three blocks of the 100-percent retail area of the city.

grams will provide additional grading estimated to cost $3,000,000 at no cost to the Chattanooga Housing Authority.

Table II. Principal public works expenditures for West Side Urban Renewal Project

Item	Estimated Cost
Grading	$ 810,150
Sewers	636,710
Streets and sidewalks	1,158,350
Electrical system	824,000
School buildings	1,050,000
Fire station	255,350
Park development	227,500
Total	$4,962,060

Since this urban renewal program is being financed with federal funds, certain project improvements are only partially eligible as project costs. Eligibility of a particular facility is determined on the basis of service to the project area in relation to its total service area. Eligible costs range from 21.7 percent for a central fire station to 100 percent for most of the streets, sewers, and schools. The total eligible costs of this program are estimated at $20,879,170, as shown in Table III.

TABLE III. Financing of West Side Urban Renewal Project

Item	Eligible Expenditures
Administration and planning	$ 732,000
Relocation and property management	122,500
Legal and land acquisition expenses	375,340
Purchase of real estate	12,998,450
Site clearance	687,250
Public works improvements	4,882,100
Interest and contingencies	1,081,530
Subtotal	$20,879,170
Less resale of land	5,141,870
Net cost	$15,737,300

Resale of land will reduce the net project cost to $15,737,300. About half of the city's participation in project costs will be met by various site improvements, while the other half will be paid in cash. Relocation payments to displaced families and businesses will require an additional federal grant of $137,350.

Planning of the West Side Project extended over a two-year period, because of the size of the area and the time required for coordination with other public programs. Project execution was originally scheduled to cover a six-year period, but the project is now ahead of schedule. It was anticipated that real estate acquisition would require four years, but about 70 percent of the real estate has been acquired in less than two years. Only 27 contested condemnation cases have been required to settle values on the 731 parcels thus far acquired.

Although a total of $495,500 was budgeted for building demolition, the Chattanooga Housing Authority has been very successful in selling structures for salvage to wrecking contractors. Proceeds from these sales have amounted to $56,000. A total of 787 residential structures and 35 non-residential buildings have been cleared from the project area; this represents 69 percent of the total number to be demolished.

Rehousing for displaced families

Urban renewal agencies have both a legal and a moral responsibility to provide safe, sanitary, and decent rehousing for displaced families. The basic objective of urban renewal has not been accomplished until site occupants have been properly rehoused. During the planning stages of the West Side Project, detailed analyses were made of housing characteristics in Chattanooga. These studies showed that many families living within the urban renewal area could afford new housing resources. As a result, approximately 425 units of for-sale housing have been constructed under the FHA 221 program.

The Chattanooga Housing Authority operates 1,931 units of low-rent public housing. Since turnover in these units is not sufficient to house low-income families displaced by the urban renewal and freeway projects, an additional 700 units are planned. Land has been acquired and a contract awarded for almost 200 of these units.

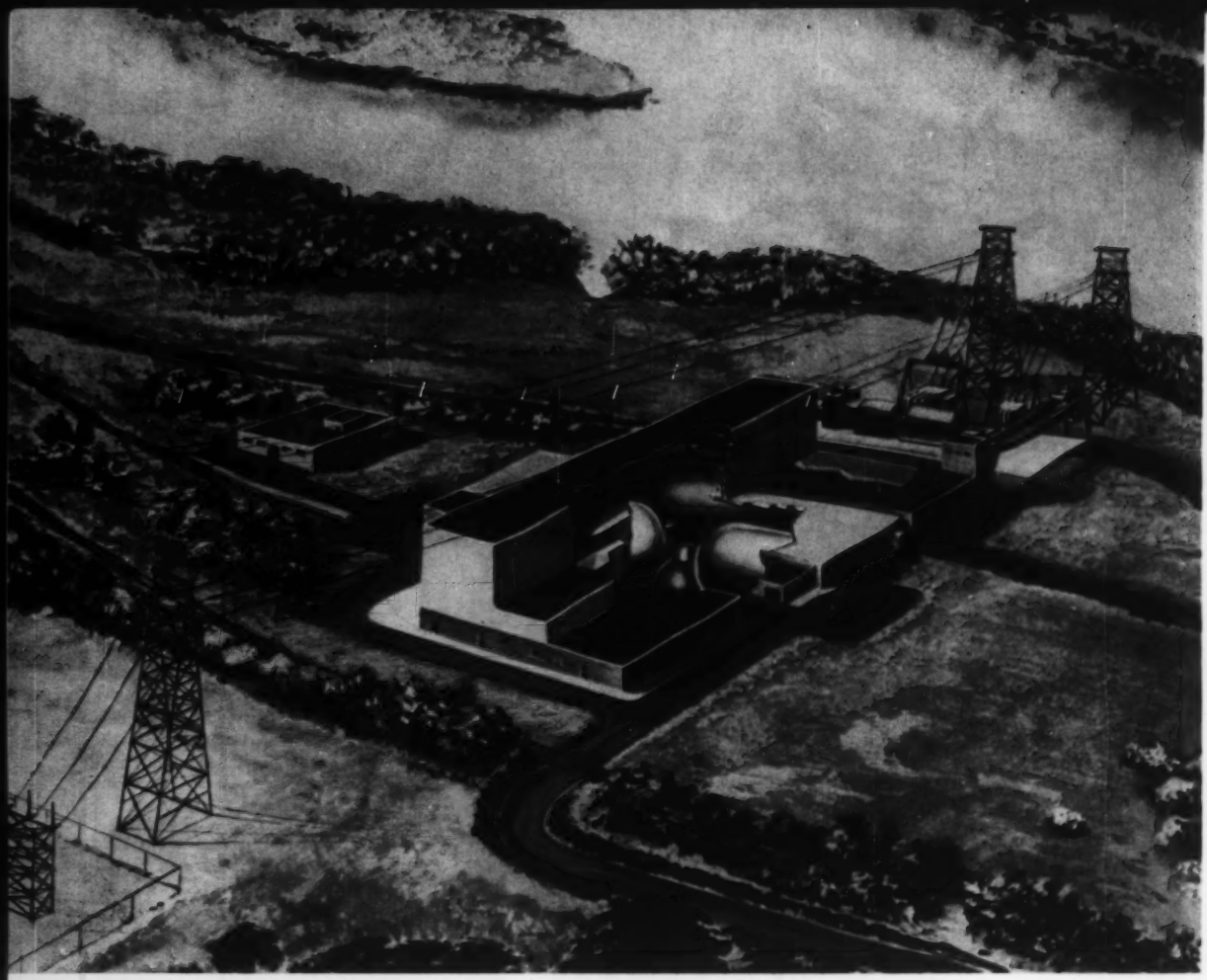
The relocation resources utilized by families thus far displaced from the West Side Project are given in Table IV. A total of 783 families have thus far been relocated from the West Side; 55.7 percent of these have been placed in standard housing.

TABLE IV. Relocation status of families displaced from West Side Project, July 30, 1960

Relocation Status	Number	Percentage of Total
Standard rental	207	13.9
Standard sales	152	10.2
Public housing	77	5.2
Substandard housing	243	16.4
Disappeared, evicted, etc.	104	7.0
Not yet relocated	701	47.3
	1,484	100.0

Urban renewal offers a great challenge to many professions—the architect, the social worker, the realtor, and the civil engineer. Conditions in various projects will vary, but the Chattanooga program vividly illustrates the importance of civil engineering in urban renewal planning. There is great opportunity for the civil engineer, *provided* he can recognize and coordinate the contributions of other professions.

The West Side Project is being undertaken by the Chattanooga Housing Authority; Edward Steiner is Chairman, Herbert Banks, Executive Director, and Billy C. Cooper, M. ASCE, Director of Urban Renewal. Site planning services were performed by Ewald and Associates of Memphis. Engineering and field inspection is being provided by the Schmidt Engineering Co. of Chattanooga. Marble J. Hensley, M. ASCE, is the Urban Renewal Coordinator for the City of Chattanooga. The writer was responsible for planning and for the initial stages of project execution.



Cutaway view of Shippingport Atomic Power Plant.

CONSTRUCTION PROBLEMS OF NUCLEAR POWER PLANTS

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Executive Officer and Assistant Director
U. S. Naval Civil Engineering Laboratory
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To get some idea of the magnitude of the construction task for nuclear power plants, consider a job of close tolerance and rigid inspection with many specialized materials that requires 30,000 cu yd of concrete; 3,000 tons of reinforcing steel; 8,000 tons of structural steel; 80,000 ft of piping with 25,000 welds, with over half the welds requiring 100-percent X-ray inspection; 700,000 ft of cable and wiring, and a peak crew of 1,000 men.

Ten years ago, there were no such plants in existence. Today there are more than ten major nuclear power plants as well as over ten smaller plants in operation or under construction in the United States alone. Along with the increased use of this new power source, have come many construction problems. Among these are:

Stainless steel pipe needed in large quantities. This gives rise to the requirement for large numbers of qualified welders of stainless steel, who are not normally available.

Compact plants with complex piping arrangements. This requires much more than the usual detailed planning of installation sequences and work schedules. It also affects the designer's method of developing construction drawings.

Inspection, rigid, thorough and extensive, and test requirements, which affect construction procedures, inspection procedures and the size of the inspection forces.

Change orders. No nuclear plant today can be considered routine. Advances in technology are being made rapidly and each designer and customer will want to take advantage of every significant technical advancement.

Even "frozen" designs will become rapidly unfrozen when the technical advancement is made.

Containment. Large steel shells are used to house the entire nuclear system, and can restrict the use of normal construction techniques.

The chief difference between a conventional power plant and a nuclear power plant is the fuel used and the method of controlling it. A cutaway rendering is shown of the Shippingport Atomic Power Station, a 60,000-kw plant which has been producing electricity for over two years. Nuclear power as we know it today comes from the fission or splitting up of certain heavy elements, such as uranium and plutonium. So tremendous is the energy liberated by this process that one pound of uranium can generate as much energy as 1,300 tons of coal.

To make nuclear energy useful as a power source, a way must be found to control the fission. Nuclear physicists have developed several schemes to accomplish this, and nuclear engineers have designed and built reactors that achieve the desired control.

Unusual plant features

There are several unusual characteristics of nuclear plants that merit consideration by designers and construction contractors. In the first place the nuclear fuel is radioactive, so that any of it which gets into the circulating system contaminates that system. Second, the nature of the nuclear reaction is such that most of the impurities in the circulating system that pass through the reactor become radioactive. Third, the material of the circulating system itself, for example, water, becomes radioactive as it passes through the reactor. With water, radioactivity is very short lived however, and dies out almost immediately when the nuclear reaction is shut down. The former two types of radioactivity, however, are long-term and must be contended with until removed.

To keep this radioactivity to a minimum, non-corroding materials such as stainless steel are used in the primary systems, and a purification bypass system is usually used to remove some of those impurities that do creep in.

Reactor plant

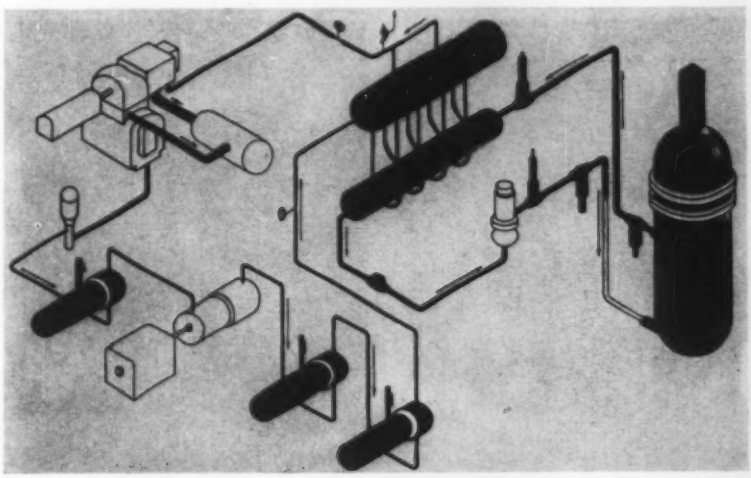
To make a reactor plant more understandable, a schematic diagram of the basic cycle of the pressurized-water reactor plant at Shippingport, Penn., is given in an accompanying illustration. The main coolant system contains water under a pressure of 1,800 psi. This water enters the lower ports of the reactor vessel at a temperature of approximately 485 deg F. In passing upward through the reactor the water is heated about 30 deg by the nuclear fuel. It then leaves the reactor through the upper ports and proceeds to the heat exchanger, or steam generator, where it passes through the primary side of a tube bundle. In passing through the heat exchanger it gives up the 30 deg of heat it gained to the water on the secondary side of the heat exchanger. The main coolant is then returned by a pump to the reactor. The secondary water is maintained at a pressure of about 600 psi and at the prevailing temperature this water turns to steam and is collected in the steam-drum part of the steam generator.

Not only must the entire primary circuit just described be constructed for 1,800-psi service, it also must contain the radioactive particles described earlier as resulting from fuel defects, impurities resulting from corrosion or other sources, and the short-term radioactive oxygen of the water. For reasons of both strength and corrosion resistance, stainless steel is often chosen as the material for the primary loop. At the Shippingport Atomic Power Station the piping of the main coolant loop is 18 in. in diameter and the walls are 1½ in. thick, of grade 304 low-carbon stainless steel. In the construction of this main coolant system, 84 welds of the full pipe diameter were required. From the standpoint of economy of material and minimum number of welds, it is evident that the primary system of a nuclear plant should be as compact as possible.

The secondary system, or the steam system, is completely isolated from any direct contact with the radioactive fluid of the primary loop. Separation is obtained at the tube walls of the heat exchanger, where the primary coolant circulates through the tubes and the secondary mixture (of water and steam) circulates on the outside of the tubes. The secondary or steam system can be considered as conventional design and construction, except for minor modifications to permit monitoring for possible radioactivity (in the event of a tube leak) and the assurance of low chloride content in the steam system. The low chloride content is required because of the deleterious effect of this material on stainless steel.

Many other systems are required in the nuclear part of the plant to permit operation of the basic cycle. These include systems to charge water and chemicals into the plant and a system to discharge water from the plant. Since the discharge of primary coolant water is radioactive it is necessary to contain the discharge for later processing. Other systems include a purification system to remove impurities from the main coolant; emergency cooling systems for the reactor in the event of loss of main coolant; a relief valve system (for plants operating at pressure); a pressurizing system to maintain an accurate operating pressure; a sampling system to determine the actual content of the main coolant system; a valve operating system for remote control of valve positioning; a component cooling water system to cool primary plant components such as pumps, reactor shield tank and control rod mechanisms; and a radioactive waste disposal system for processing all radioactive discharges and wastes from the plant. A number of electrical control systems are also

Basic schematic of the Shippingport pressurized water reactor.



needed, but these are not subject to radioactive contamination in the way that the fluid systems described above are.

Energy requirements

At this point the question may be raised as to whether so much effort is really worth while in view of the much simpler techniques involved for a conventional power station. However, many people are already asking whether the destructive use of coal, oil and gas is wise. The use of these basic materials as direct contributions to chemical processes such as the manufacture of steel, the production of synthetic fibers and even the synthesis of food gives them a value that may far exceed that of the heat liberated in their combustion.

It would seem evident then that nuclear power plants are more than a passing fancy and that attention to the solution of problems unique to the construction of such plants is important.

Special materials

The first problem to be considered is that of using special materials for substantial parts of the job. Stainless steel is used in large quantity in nuclear plants, especially for piping. The welding of stainless steel requires procedures and experience quite different from the welding of carbon steel. When the piping is to contain radioactive or potentially radioactive fluids it is important that no cavities or crevices be present along the pipe walls. For this reason no backing rings can be used in pipe joints. Consumable inserts have been developed and used successfully for welding stainless steel pipe. Since oxygen must be excluded from the weld area, a tungsten arc bathed in helium is used for making the root pass. As the interior of the pipe must be free of all but inert materials, an argon purge is usually required. After one or two heliarc passes are completed, the remainder of the weld can be made with the metal arc process.

It was found at Shippingport that it took about three weeks of training for a qualified carbon-steel pipe welder to become proficient in welding stainless steel. For a job the size of Shippingport, over 200 welders had to undergo an average of three weeks of intensive training in special facilities set up solely for training.

Close working space

The second problem is that of a complex plant in a compact area. To keep the cost of materials and welding down, the major components, such as reactor vessel, steam generators and pumps, are placed as close together as possible. This also means that the biological shielding, which must enclose the primary plant, can be made smaller. When all the equipment and systems previously mentioned are packed into as tight a volume as possible, a real problem is created for the constructor. A typical working space is shown in an accompanying photo.

One approach to the problem used was to consider the work to be done by physical areas or volumes, to have the construction drawings developed in this manner, and to assign the work to teams by area. With this approach, all equipment and piping in a given area was installed by one crew or shift of crews. Under this system, an area crew had to use a minimum of drawings in accomplishing its work. Coordination between areas and between trades in a given area was particularly important. It was found that area superintendents were needed in addition to the normal job superintendents. Some areas were no more than 35 ft in diameter, but the maze of equipment, piping, and electrical facilities made these small physical areas into comprehensive installation areas.

The area method was effective for about the first 80 percent of construction. At that point it became necessary to perform partial testing of systems. Consequently it became desirable to complete individual systems in preference to completing 100 percent of all the work in a given area. Thus the emphasis gradually shifted near the end of the work from the area concept to the system-completion concept. When about 80 percent of the construction was completed, small system teams were formed, whose job it was to complete particular systems or parts of systems that extended from one area to another. These system teams usually, but not always, worked on a separate shift from the area teams.

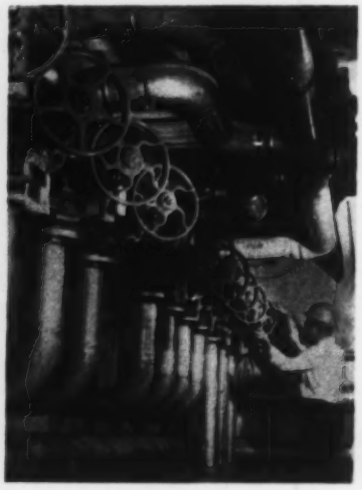
As construction neared completion, more men were moved from the area teams to the system teams. Close behind the system teams came the test teams, who checked out particular systems for completeness and then carried out the hydrostatic or electrical tests on the system. Once checked out, each system was turned over to the operator, who then started normal operating procedures, including his own tags on all control points in the system, so that accidental activating of systems would not occur through inadvertent actions of either the operating or the construction forces.

Rigid inspection

One of the distinguishing characteristics of nuclear power plant construction is the scope and degree of inspection required. In the first place, systems carrying radioactive fluids are designed and constructed for zero leakage. Practically every weld in these systems is dye checked for surface defects and is also X-rayed for internal defects. The size and organization of the inspection group for this function alone can well be imagined for a plant having 25,000 welds. In addition, various schedules of pipe are used, depending on the pressure and service involved. It is most important that pipe of the correct schedule be used for each application. For this reason, strict warehouse procedures and control are required, as well as clear and thorough identification of piping as it is brought to the job site. One method

Stainless-steel weld in 18-in., 1,800-psi line.

Typical working space for nuclear construction.



that has been used successfully to identify pipe is an indelible color coding placed along the entire length of every piece of alloy piping at the manufacturer's plant.

Cleanliness is extremely important because every piece of dirt, grease, scale, and foreign material left in a system can eventually find its way to the reactor and not only become radioactive but, if of sufficient size, can lodge in one of the narrow passages in the nuclear fuel area and interfere with proper heat transfer, possibly causing a serious defect in the fuel. One method is to start with completely clean materials and to maintain them that way throughout the construction and acceptance testing. This was essentially the method used at Shippingport. It required chemical cleaning of piping and components on receipt, capping or otherwise sealing of openings, and making sure that no dirt or foreign material could enter when the pipe or other component was welded into the system.

In addition to these steps, each hydraulic system was flushed with large quantities of very pure water, and the effluent was examined by screening it through cloth screens to determine when no more dirt or foreign material was being carried out by the water. If flushing is to be used, the designer can help considerably by taking it into account in laying out his piping runs, expansion bends, and system interconnections. Early planning in the construction sequence can also be of value. Flushing rates were determined by using flow rates slightly in excess of design flow rates, so that any particles that could be expected to move in service flow would come out in the flushing tests.

A final step to insure cleanliness was taken at Shippingport by placing a filter trap in the reactor vessel before insertion of the nuclear core, and operating the fluid systems in a normal manner. The previous cleaning procedures, construction care, inspection, and flushing had been so effective that only negligible impurities were picked up by the reactor-vessel filter.

The cost of cleanliness is high. Improved methods of assuring a clean reactor system, but with reduced cost and effort, are needed and will undoubtedly be found.

Change orders

Change orders are always the plague of the constructor. In nuclear power plant construction not only do the usual changes occur as a result of physical interferences, particular equipment purchased, and rechecking the designer's calculations, but significant advances in technology are being made rapidly. Many laboratories are developing improved materials and improved techniques and finding out more about the nuclear process itself. If a greatly improved chemical treatment is developed during construction, it is worth while for the customer to incorporate provisions for it in the plant. This may mean cutting into existing systems for new interconnections, or holding up shop fabrication for new drawings, but the promise of improved operating performance or safety will outweigh the added construction cost and scheduling difficulties.

There is a point however at which changes must stop. Improvements are being made so fast that a plant that was always kept up to date would never get into operation. The point of cut-off is really the customer's responsibility, but the constructor can assist materially by establishing good communications with the input end of the designer's organization, so that any new requirement can be rapidly analyzed for construction difficulties before it is processed all the way through the design stage. A realistic analysis can then be presented to the customer for decision before considerable effort has been expended and a "stop" order placed on construction.

To assure maximum safety to the public, all parts of the primary nuclear plant are placed inside of a large container which is closed during the normal operation, and which is of such a size that should the worst conceivable accident occur to the nuclear plant, all the products of the accident would be hermetically sealed inside the container. This usually entails a consideration of vapor at some finite pressure and elevated temperature. Containment vessels are sometimes large vertical cylinders with hemispherical ends, sometimes large spheres, sometimes horizontal cylinders. There can be other shapes or combinations of shapes.

Interior of plant containment vessel.

In the case of Shippingport three interconnected cylindrical and one spherical container were built and pressure tested first. Then the plant was installed through overhead hatches. A considerable restriction on construction techniques results from this process. One of the containment vessels at Shippingport before the plant was installed is shown in an accompanying photo. Note the access hatch through which plant equipment must be lowered. Other plants now being built are designed for partial construction of the containment vessel, construction of the plant proper, and then completion of the containment vessel, the pressure testing of the shell being performed with the plant inside. This method seems to be gaining in favor.

Many problems naturally present themselves in any undertaking of the magnitude of a large-scale nuclear power plant. However, construction engineers are in the business of identifying and solving problems, and the wider their experience the better their results. Nuclear power is coming and I'm sure the construction industry will not want to be caught short in thinking that a nuclear power plant is just another job. It isn't!

(This paper was originally presented at the ASCE Reno Convention, before a Construction Division session.)

For long-range planning of a community, engineers must consider traffic flow. Norfolk's Hague area, east, is seen here

Norfolk builds for the future

J. H. WEIDMAN, Engineer,
DONALD R. LOCKE, M. ASCE, Engineer,

Norfolk started early on redevelopment of its old central area and has now relocated 5,568 families. Urban renewal has been extended far beyond the 127 acres of slums included in the program considered by the Redevelopment and Housing Authority and the Norfolk City Council in 1949. The program now embraces about 465 acres in the heart of the business district. More than half of what traditionally has been the financial and trading center of Tidewater Virginia and northeastern North Carolina is in the area rebuilt or in process of rapid change.

The concept of urban renewal as an exclusive tool of the Federal Government has changed drastically since the combined Authority and city program was launched ten years ago. Private organizations and individual property owners are now doing their share in a combined program that is giving new vitality to the community.

As at present constituted, the program will entail expenditures of $183 million within project boundaries when completed some years in the future. Included in the project are commercial buildings, manufacturing and distribution plants, office structures and the like. The urban renewal bill will be in excess of a half billion dollars when all its aspects are included, both public and private projects made possible or stimulated by the massive attack on downtown Norfolk slums. Of special interest are highway crossings of water courses, usually in tunnel, in this tidewater area where shipping is of top importance to commerce.

A bridge and tunnel to neighboring Portsmouth by way of the Elizabeth River represented closely integrated planning by the Elizabeth River Tunnel Commission and city and Authority engineers, plus their fellow professionals on the state and federal level, and project consultants. Virtually the same collaboration was needed in building the 3.5-mile Hampton Roads Bridge and Tunnel, opened in November 1957, five years after vehicular traffic began flowing through the Elizabeth River Tunnel.

In progress is a second tunnel to Portsmouth, involving even closer teamwork among the engineering complex consisting of the Elizabeth River Tunnel Commission, the city, the Au-

before and after construction of the Hampton Boulevard-Brambleton Avenue Connection.

Norfolk Redevelopment and Housing Authority, Norfolk, Va.

City Planning Commission, Norfolk, Va.

thority, and the state and federal governments. Plans are also progressing to include parts of a new Interstate system made possible by city rebuilding.

Virginia's greatest engineering undertaking, the 17.6-mile bridge and tunnel crossing of Chesapeake Bay, is the crowning achievement of the contagious aspects of an urban renewal program in revitalizing a community and a broad area of its surroundings. The $140-million fixed crossing will replace the Kiptopeke Beach–Little Creek Ferry and will require three years to complete. It will consist of a mile-long tunnel under each of two deep-water navigation channels, two bridges spanning navigable streams, some 11 miles of trestle elevated above wave action, and 9,000 ft of causeway and embankment.

More tangible evidences of urban renewal, both public and private, are to be observed in Norfolk proper, for example, such public undertakings as:

A new civic center, with the first unit, a $4.8 million public safety building, nearing completion on a 17-acre tract carved out of the city's oldest business section. A new municipal building and another to house the state courts will be under construction soon.

A regional medical center, which is nearing completion. It centers around the new $5.5 million wing of Norfolk General Hospital. A major unit, the million-dollar Public Health Center, was opened recently. Now ready for occupancy is a 10-story, $2.5-million Medical Office Tower for doctors and dentists, and a new million-dollar King's Daughters Hospital, which will have a physical connection with Norfolk General.

A new central city urban highway system, most of the right-of-way for which came from the land areas once covered by slums and blighted structures.

But that's not all. Among the privately sponsored projects that should be mentioned are:

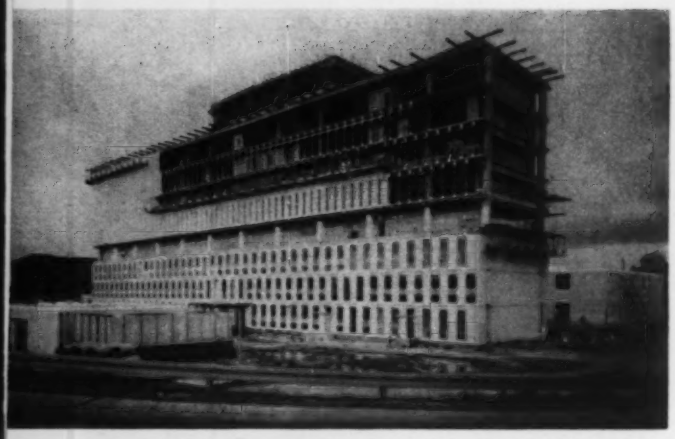
The new Maritime Tower, a 15-story multipurpose building in the heart of the business district. It houses a major department store, ramp garage facilities for 750 cars, a restaurant, and eight floors of office space. The cost approximated $6 million.

The Golden Triangle Motor Hotel, a 14-story combination motor hotel and office building to cost $6.5 million. It will be ready for occupancy next June and will contain three floors of office space. The steel framework was finished in mid-August.

The Lafayette Yacht Club, spread over 8.5 acres on what formerly was a marshy river-side dumping ground, one of the finest yacht clubs in the nation. Representing an investment of $2.5 million, it has pier space for 150 pleasure boats and will boast an olympic-size swimming pool, largest in the South. The clubhouse was opened in September.

Among other evidences of the spirit of urban renewal are numerous remodeling projects affecting old homes, neighborhoods, and commercial structures. But even more impressive are the scores of well designed business, manufacturing, and industrial buildings that are being erected on reclaimed land or elsewhere.

The 400-acre Norfolk Industrial Park is a prime example. A $5,000,000 distribution center for one of the nation's largest grocery chains was opened early this year. Several other manufac-



Norfolk's urban renewal program includes a $15-million Civic Center. Nearing completion is the $4.8-million Public Safety Building, which will house Norfolk's jail and some municipal offices. Site for the new Civic Center is a 17-acre tract carved out of the city's oldest business section.

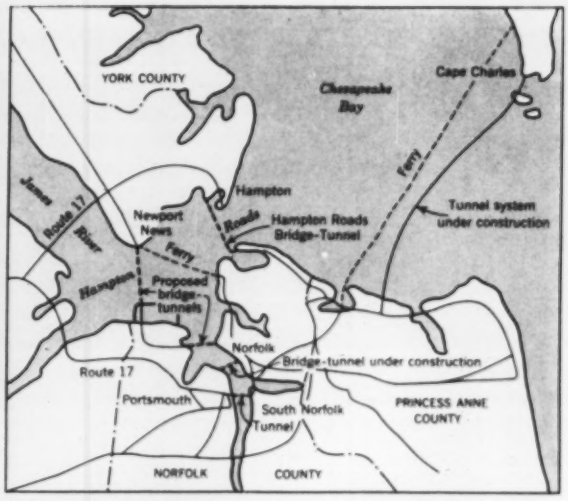


FIG. 1. Arterial highways, bridges and tunnels play an important role in Norfolk's urban renewal program.

turing plants are in operation or projected. More are coming.

Illustrative of the urban renewal spirit was the organization several years ago of the Tidewater Virginia Development Council, the industrial promotional agency for 18 political subdivisions which is headquartered in Norfolk. An offshoot of TVDC is the recently organized Southeastern Virginia Regional Planning Commission which, through federal and other sources, has a $50,000 budget to begin this year a master plan for the region. Most of the members are professional engineers.

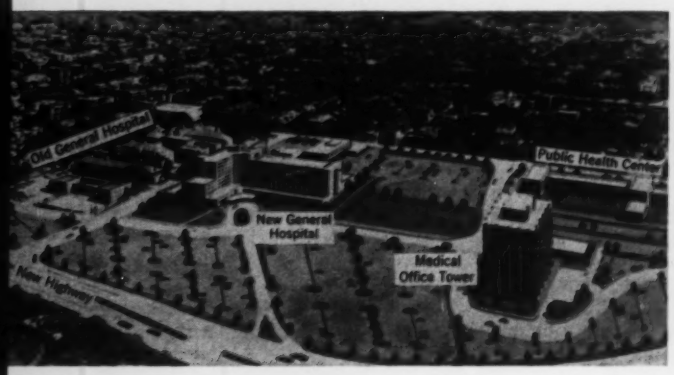
A decade ago, Norfolk's central business district was a maze of narrow streets surrounded virtually on all sides by deteriorating structures. To complicate matters, railroad trucks hemmed in the greater downtown area on the north and east, and the Elizabeth River imposed a natural water barrier on the other two sides.

The flight of business firms to the suburbs was another complication that accentuated Norfolk's fiscal problem. But the outlook has changed, mainly because of the intensive face-lifting program. It was made possible through urban renewal legislation inaugurated with the Housing Act of 1949 and expanded by subsequent legislation, notably the Housing Act of 1954.

Projected as part of the Downtown Redevelopment Project, largest such undertaking in the South, are even greater transformations, including the new Civic Center which is within its boundaries. One or more pedestrian malls are in the plans, along with a new commercial section carrying out the architectural design of the Colonial era. One of the malls will be flanked by new retail stores, and the other by office buildings in an expansion of the city's financial hub.

A major department store, plus a complex of office buildings, are among other improvements in the early planning stages. There is talk of converting Granby Street, the city's major thoroughfare, into another pedestrian mall. But the latter undertaking must necessarily await extension of the urban highway system and availability of part or all of the 7,200 off-street parking spaces to be provided by the Downtown Redevelopment Project.

BELOW, LEFT: Regional Medical Center nears completion, as shown in architect's rendering. The Public Health Center was recently opened, and now being occupied is a 10-story, $2.5-million Medical Office Tower and a million-dollar King's Daughters Hospital, adjoining the new $5.5 million General Hospital addition. BELOW, RIGHT: Golden Triangle Hotel rises in Norfolk's downtown business district. The $6-million, 13-story structure is expected to attract conventions next year.



The Brooklyn pier site before dewatering. An island that was once Fort Lafayette provided some work space and permitted use of a single line of sheetpiles for part of the cofferdam.

Cutting edge of caisson in place in cofferdam at Staten Island. Note dry bottom in sand at 17 ft below high-tide level. Water depth increases rapidly to nearly 100 ft at mid-channel.

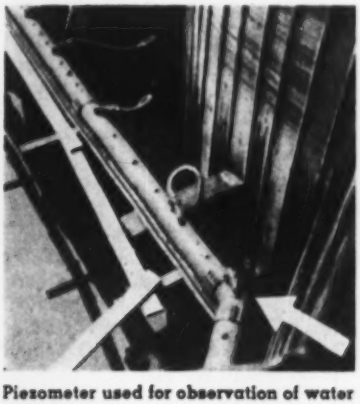
Wellpoints dewater sites for Narrows Bridge piers

JOHN F. HOFFMAN, M. ASCE, Director of Research and Development, Griffin Wellpoint Corp., New York, N. Y.

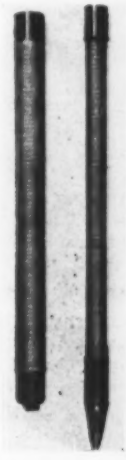
Wellpoint dewatering of sheetpile cofferdams permitted the successful placement below river level of the cutting edges for caisson piers of the Verrazano-Narrows Bridge. Located at the entrance to New York harbor, this bridge will have the world's longest suspended span, 4,260 ft. When completed in 1965, it will connect the parkway systems of Long Island with New York's Borough of Richmond and the highways of New Jersey. Towers supporting the long suspension span will rise 690 ft above caissons that will bottom at 130 ft below mean sea level on the Staten Island side and at 200 ft below on the Brooklyn end.

The piers are being constructed as a joint venture of J. Rich Steers, Inc., and the Frederick Snare Corporation of New York under a $16.5 million contract. The work is being done for the Triborough Bridge and Tunnel Authority for whom Ammann & Whitney are engineers.

Each pier is basically a honeycomb box of reinforced concrete containing



Piezometer used for observation of water level in the sand at the inside edge of the cofferdam.



◀ Both high-capacity "Aquahogs," left, and standard wellpoints, right, were used in dewatering the cofferdams.

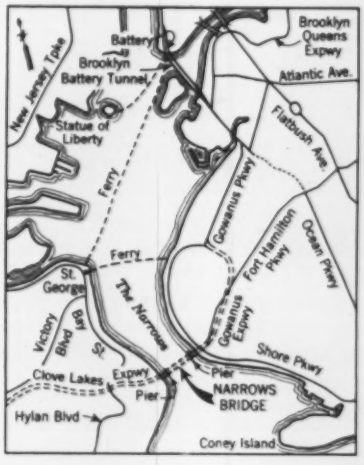
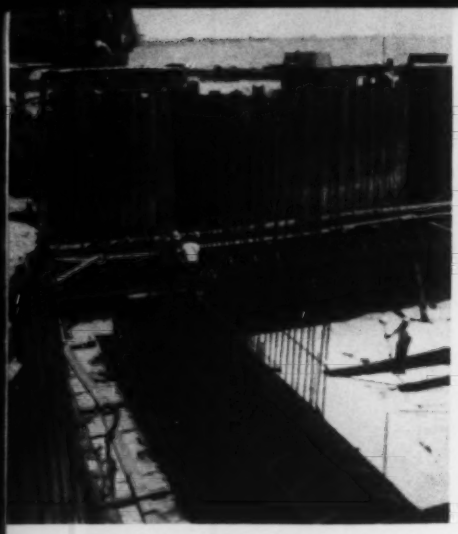


FIG. 1. Verrazano-Narrows Bridge connects Brooklyn with Staten Island. Tower piers for the 4,260-ft suspended span are each a few hundred feet offshore in water 14 to 25 ft deep. ▶



Wellpoint installation placed tight against the cofferdam, leaves adequate working space around the cutting edge.

Three Griffin high-capacity wellpoint pumps were set up for dewatering each cofferdam but only two were needed. Note brackets welded to the sheetpiles to support the wellpoint equipment and serve as stairs.

66 circular wells 17 ft in diameter. This caisson is sunk by dredging through the wells as additional weight is added by incremental lifts of concrete on its top. The caisson box is constructed on a steel cutting edge built to an outside dimension of about 130 ft by 230 ft. To provide a space in the dry for assembling the cutting edge and to provide a working platform for constructing the pier, a rectangular cofferdam of steel sheetpile cells 49 ft in diameter was built at each of the two pier sites.

The elevation of the lower edge of the sheetpiling ranged from El. −25 to −45 in reference to mean sea level on the Staten Island side and from El. −30 to −45 on the Brooklyn side. The sheets were driven deeper on the channel side, where the depth of The Narrows increases rapidly to nearly 100 ft at mid-channel. The top of each cofferdam was established at El. +12. On the Brooklyn side, the presence of a tiny island, the site of Fort Lafayette, permitted use of a single row of steel sheetpiling in lieu of circular cells for about 40 percent of the periphery of the cofferdam. The single sheetpiles were tied back to a concrete wall and further stabilized by a backfill of concrete rubble placed against the outside of the piling.

Water inside a cofferdam can be lowered either by open pumping or by wellpoints, or by a combination of the two. In pervious material, such as exists here, extensive lowering of the water inside the cofferdam by open pumping may cause a "quick" condition in the subgrade. The quick condition is caused by the pattern of water seepage through the soil underlying the cofferdam. When the forces created by the upward flow of water are equal to the submerged weight of the soil, an unstable condition occurs. "Boils" may appear, usually along the walls of the cofferdam first, and a "blow" may follow, during which the cofferdam is filled with water and muck. Because the soil loses its bearing capacity, the cells may be wracked and twisted, causing extensive delays and possible injury to personnel.

Wellpoints placed within the cofferdam near the elevation of the lower inside edge provide a sure way of preventing the occurrence of this unstable condition. Most of the seepage entering the cofferdam from beneath is intercepted by the wellpoints before it moves upward. This flow is diverted to the wellpoints in such a way that movement of sand does not occur. The minor quantity of seepage that does escape initial interception by the wellpoints flows into the cofferdam near the center. Ultimate capture of this water takes place, however, for it eventually moves downward within the cofferdam near the sheetpiling to the wellpoints.

Basic information from eleven borings for the cofferdam on the Staten Island side, and seven borings on the Brooklyn side, were available together with soundings of the river bottom. Shown in Tables I and II are logs of representative borings from each cofferdam. The soil down to about El.

TABLE I. Soil description from a representative test boring

At site of Staten Island cofferdam
Pier to be founded at about 130-ft depth

El. Below Mean Sea Level	Thickness, ft	Soil Description
0 to 23	23	Water
23 to 36	13	Coarse to fine sand, some medium to fine gravel, trace of silt
36 to 76	40	Coarse to fine sand, trace of silt
76 to 85	9	Coarse to fine sand, little silt, little fine gravel
85 to 88	3	Coarse to fine gravel, some coarse to fine sand, little silt
88 to 89	1	Boulder
89 to 95	6	Coarse to fine sand, some silt with many thin layers of silt and clay
95 to 133	38	Fine sand, trace to little silt
133 to 169	36	Silty clay
169 to 194	25	Coarse to medium sand, trace of silt, trace of fine gravel
194 to 214	20	Decomposed mica schist
214 to 274	60	Bedrock—mica schist

TABLE II. Soil description from a representative test boring

At site of Brooklyn cofferdam
Pier to be founded at about 200-ft depth

El. Below Mean Sea Level	Thickness, ft	Soil Description
0.5 to 10.5	10	Water
10.5 to 18.5	8	Fill of coarse to fine sand, little silt, some gravel, brick
18.5 to 33.5	15	Coarse to fine sand
33.5 to 45.5	12	Medium to fine gravel and coarse to fine sand, trace silt
45.5 to 80	34	Medium to fine sand, trace silt
80 to 90.5	10.5	Fine sand
90.5 to 154.5	64	Organic silty clay, streaks o fine sand to clayey silt
154.5 to 179.5	25	Stone fragments, occasional boulders, some sand, little organic silt
179.5 to 198.5	19	Varved silty clay, streaks of fine sand
198.5 to 222.5	24	Silty clay, streaks of sand and silt
222.5 to 240.5	18	Medium to fine sand, little silt
240.5 to 269.5	29	Silty clay, little coarse to fine sand
269.5 to 277.5	8	Decomposed rock
277.5 to 297.6	20	Granite gneiss

−100, as indicated by split-spoon samples, was for the most part coarse to fine sand with occasional traces of silt. Below this elevation the material was of a lower permeability.

The necessity for handling large quantities of water during the dewatering of the cofferdams was evident from the information available. There was no naturally protective cover to reduce the seepage through the river bottom into the cofferdams. In addition, the depth of The Narrows increases rapidly on the channel side of each cofferdam, so that an open body of water was only a short horizontal distance from the lower edges of the cofferdams.

A wellpoint dewatering system was designed for each cofferdam by the Griffin Wellpoint Corp. and installed under its supervision. These closely resembled the Griffin wellpoint systems utilized in the construction of the anchorages of the Throgs Neck Suspension Bridge a few miles away. (See CIVIL ENGINEERING, Oct. 1959, vol. p. 706.) As preliminary analysis indicated the necessity of handling large quantities of water, high-capacity wellpoints, known as "Aquahogs," were installed against the inner walls of each cofferdam. Water that might seep upward at the center of the cofferdam was intercepted by standard wellpoints also installed against the sheetpiles but at a shallower depth.

Standard wellpoints were jetted into place; the Griffin "Aquahogs" were placed with a holepuncher. A holepuncher is a heavy-duty pipe with a weighted head through which water is jetted at high pressure. Once positioned at the predetermined depth, the top of the holepuncher is opened, a wellpoint inserted, and the holepuncher withdrawn, leaving the wellpoint in place.

Efficient drainage of the stratified soil beneath the Brooklyn cofferdam required the use of a sand filter around each wellpoint. This sand filter, more commonly termed a "sand wick," is a vertical drain to which water perched on layers of low permeability seeps horizontally. Once at the wick, the water seeps vertically to the wellpoint screen. Installation of these wicks required the use of a special heavy-duty pipe, known as a sanding casing; this is 12 in. in diameter and a few inches shorter than the holepuncher. Soil dislodged by the holepuncher is flushed to the surface in the annular space between the holepuncher and the sanding casing. After the prescribed depth is reached, the holepuncher is removed, a wellpoint inserted, a graded filter sand added, and the casing removed.

Three high-capacity Griffin 1210 wellpoint pumps, each capable of handling more than 4,000 gpm, were installed in each cofferdam. Two pumps did the work while one was kept in operating condition as a standby. A wellpoint pump differs from an ordinary centrifugal pump in two respects: the wellpoint pump usually has a suction lift greater than 25 ft, and each wellpoint pump is equipped with a vacuum pump to exhaust any air that may leak into the suction side of the system. Thus the vacuum pump helps to maintain the high-lift characteristic of the centrifugal pump. In addition to these special features, most wellpoint pumps also have extremely good total head characteristics. The pump battery for the Staten Island cofferdam is shown in a photo. Water within the cofferdam was lowered by open pumping to permit placement of brackets at El. −6 to support the wellpoint pumps. Discharge piping extended horizontally through the cell walls.

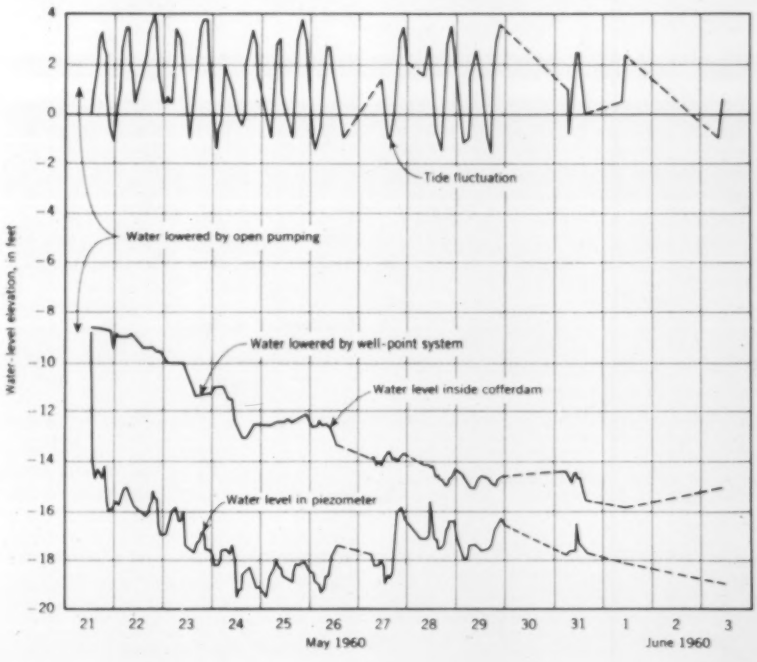
Like the pumps, the header pipe was supported on H-beam brackets welded to the cell walls. The header pipe and the wellpoints were placed at the same time. Short lengths of reinforced rubber hose were used to connect the wellpoint risers to the header pipe.

It is quite important to know the pattern of water movement through the soil underlying a cofferdam. Accordingly, 20 piezometers within the Staten Island cofferdam and 17 piezometers within the Brooklyn cofferdam were installed at strategic locations and depths.

What were the results achieved using the wellpoint installation? Wellpoints were employed on this project for two purposes: (1) to lower the water level within each cofferdam as rapidly as possible, and (2) to maintain a stabilized bottom during the lowering of the water. A graph of the water-level decline inside the Staten Island cofferdam is shown in Fig. 2. Also shown for the same period are the tidal stages and water levels in a typical piezometer screened near the lower edge of the sheetpiling.

Before operation of the wellpoint system, the water level in the Staten Island cofferdam was lowered to El. −8.7 by open pumping while the water level in the typical piezometer was at El. −7.5. Flow at the walls and elsewhere within the cofferdam was in an upward direction. Shortly after the start of the wellpoint pumps, the water level in the piezometer declined to El. −14.6, indicating a reversal of flow at the walls to a downward direction. Within six days after the wellpoint pumps on the Brooklyn side were started, the first section of the cutting edge was placed. A comparable goal was obtained on the Staten Island side after ten days.

FIG. 2. Tidal variation outside the Staten Island cofferdam and water level inside. The piezometric levels, taken near the lower edge of the sheetpile cells, indicate the effectiveness of the wellpoints.



Stadium at Penn State University has been relocated and enlarged to seat 45,000. The rebuilt structure includes steel deck units erected in 1934, moved along with other material from six additions to the structure.

All steel-deck stadium

JAMES H. McCARTNEY, A.M. ASCE, Engineer

The college campus also expands into a need for redevelopment as more buildings are required in the central area. The athletic field usually is the first old unit to go—to a spot where there is room for parking and further expansion. Penn State development has resulted in this move, which was foreseen nearly thirty years ago when stadium seat construction was started in movable steel.

On September 17, the nation's largest all-steel deck stadium was dedicated at a new site on the campus of Pennsylvania State University at University Park, Penn. This immense structure, which now seats nearly 45,000, represents a new epoch in unitized steel-deck grandstand construction. It was designed so that it could be economically moved, and it has now been erected 1½ miles from its first location near the center of the campus.

In the first phase of construction, back in 1934, a 2,400-seat stand was provided. By 1949, through a series of extensions and additions, the seating capacity had reached 30,000. And this fall, with the recently completed relocation and expansion, its capacity has been boosted by 15,000 seats, to make the current total.

Substantial savings

Advantages of the all-steel-deck type of unitized construction, recognized by the University Planning Board in the early 1930's and confirmed over the years, are permanence, expandability and mobility. Then too, it has saved the University many thousands of dollars. It is estimated that the recently completed project represents a saving of $300,000 as compared to a completely new, all-steel deck stadium, and well over $750,000 as compared to a new all-concrete structure.

The need for the present relocation and expansion became obvious in the early 1950's. The rapid growth of the University made it clear that many new academic buildings and related facilities would be needed within a few years. In keeping with the University's long-range plan to retain a "walking campus" it was necessary that these facilities be placed near the center of the campus. Space required for this purpose included the site of Beaver Field, which meant that the stadium would have to be moved.

Greatly expanded seating capacity was also necessary because of the increase in student enrollment. Enrollment by 1960 was expected to reach 20,000 and it did. By 1970 enrollment is expected to reach 25,000 and it probably will.

In September 1958, the University Committee retained Michael Baker, Jr., Inc., of Rochester, Penn., consulting engineers, to make a complete study of the existing Beaver Field facilities together with projected requirements for their relocation and expansion. The firm reported that it was entirely feasible both from an engineering and from an economic standpoint to relocate and expand the stadium in an area that would provide space for parking as well as for increased seating capacity.

Contracts for the new facility were awarded in February 1959. The contract for dismantling the existing all-steel deck stand and press box, moving it

Original 2,400-seat steel-deck grandstand was erected in 1934. After 26 years it was moved and reerected as part of the new stadium.

Dismantled sections, 18 by 20 ft, are loaded on flat-bed semi-trailers for transport to new site.

moved to new site

Pittsburgh-Des Moines Steel Company, Pittsburgh, Penn.

1½ miles and reerecting it, plus the fabrication and erection of about 15,000 new seats, was awarded to the Pittsburgh-Des Moines Steel Company. The schedule of operations was a critical factor. Dismantling of the existing structure could not begin until the end of the 1959 football season, yet the relocated and expanded structure had to be ready for the 1960 commencement exercises. Obviously this meant the closest coordination in all phases of the operation and among all the contractors.

Addition built first

Work at the new site commenced almost immediately. Grading, foundations, team locker rooms, rest rooms and other facilities for the new stadium were well under way by the beginning of the summer of 1959. The 15,000-seat addition, using 1,280 tons of new steel, was built that summer, leaving the old stadium intact for games last fall. The addition included 30 rows on both sides of the field and 40 rows in front of the press box. (See Fig. 1, area 7.)

The field crew started work on the east side of the field by erecting all structural members and deck plates. As this crew moved to the west stand, a finishing crew moved in on the east stand, welding the deck plates, tightening bolts, and the like. All bolts used were high-strength. The crews finished both new stands by October 1959. Visitors to the campus at that time joked about a "stadium on stilts." Still to be installed in the new sections were the seat brackets and seat boards, handrails and exit ramps.

A 35-ton P & H truck crane with an 80-ft boom and a 30-ft jib was used to erect all the new steel. A Murphy diesel generator furnished all power necessary to operate both the Hobart and Lincoln electric welding machines and a Chicago pneumatic air compressor.

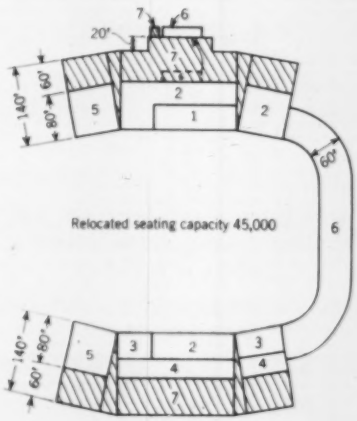
Following the closing game of the 1959 football season, the dismantling crew went to work on the old structure, parts of which had seen 26 years of service. The 1,100 tons of steel were dismantled in about 700 pieces, moved 1½ miles, and reerected in the newly completed superstructure "on stilts." In its new location, this steel, which has already given a quarter of a century of service, is expected to serve for another generation or more.

Moving a 30,000-seat stadium

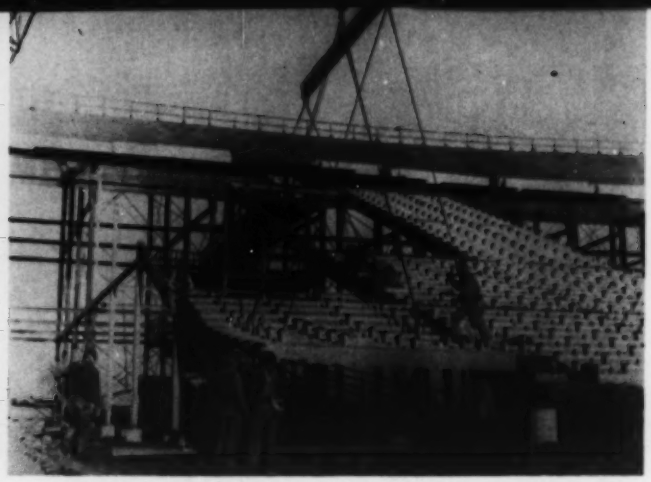
The field crew went to work at the old Beaver Field site on November 16. The first step was to paint piece marks on every steel section that was to be dismantled and moved, and to mark all places where the stand was to be cut apart. Next the seat boards were removed as were all sway rods and wind bracing. Bolts were removed throughout, leaving only enough bolts to prevent collapse. The crew removed the steel deck plates in bays that were 18 ft by 20 ft deep. A special lifting beam and sling were used. All dismantling was done using a P & H truck crane.

For a job of this nature, preplanning is one of the most important factors. It was essential for the engineers of the Pittsburgh-Des Moines Steel Company to carefully plan every move in order to coordinate the dismantling proce-

FIG. 1. Stadium at Penn State has had six major additions in 26 years and has just been moved to a new location.



The 15,000-seat addition to the new Penn State stadium was erected "on stilts" while the old structure was in use for last season's games.



A special sling handles sections of the old 30,000-seat stadium, which are erected next to the higher new elements, seating 15,000. Note the round support columns, formed with paper tubing.

dure with the erection. Structural members and deck plates were loaded on flat-bed trailers and moved to the new site as they were needed by the erection crew. Erection progressed in the same order as dismantling. A Manitowoc 3000 B crawler crane with an 80-ft boom was used to reerect the steel.

The welded steel press box was the last structure to be dismantled, moved and reerected. This four-story structure was taken down by panels and the structural support framework disassembled. It was necessary to raise the height of the press box about 35 ft at the new site. This put the first floor of the four-tier press box 66 ft above the ground level and the top more than 100 ft up. The contract provided for an elevator, which was furnished and installed by Westinghouse.

Erection of seat boards, handrails and most of the painting were completed in time for the 1960 commencement exercises. New 2 x 10 seat boards of Douglas fir, all vertical grain, were installed throughout the stadium. The lumber was treated with a Wolman wood preservative before painting.

During the early summer of 1960 a final coat of paint was applied, the playing field was sodded and other construction details were completed so that by early August the new football stadium was ready for use. The completed all-steel deck structure, shaped like a horseshoe (or, as they say at Penn State, like an open book) is now 70 rows deep on both sides of the field —from goal post to goal post—with 80 rows in front of the press box. The stand around the north end of the field is 30 rows deep. General construction was handled by Wilson-Benner, Inc., and buildings were put up by G. M. McCrossin, Inc., both of Bellefonte, Pa.

Formal dedication was held on September 17, 1960, at the opening game of the 1960 season, when Penn State defeated Boston University by a score of 20 to 0.

TABLE 1. Expansion of Penn State University Stadium

Contract No.	Contract Date	Description	No. of Seats	Tons of Steel
1	1934	West side, 20 rows x 180 ft	2,400	85
2	1936	West stand, increased to 40 rows x 306 ft	5,800	115
2	1936	East side, 20 rows x 180 ft	2,400	85
3	1937	East stand, increased in length of 20 rows to 306 ft	1,700	60
4	1939	East stand, increased to 40 rows x 306 ft	4,100	150
5	1948	East & west stands —increased in length of each 40-row stand to 378 ft	3,500	132
6	1948	North end of stadium—enclosed with 30-row horseshoe stand	9,600	377
6	1949	Four-story welded-steel press box		93
7	1959	Relocation of 30,000-seat stadium and addition of 30 rows behind both east and west stands (40 rows in front of the press box) and elevator	15,000	1,280
		Totals	44,500	2,377

All of the steel structure, constructed from 1934 through 1959-1960, was handled by Pittsburgh Des Moines Steel Co.

The big decision

Actually, the story of the Penn State stadium expansion dates back to the early 1930's, when the University Long Range Planning Board considered replacing the then existing wooden bleachers at Beaver Field with a permanent type of grandstand. They considered three important factors:

1. The Beaver Field site in the future would be needed for academic buildings.

2. The stadium would have to be increased in size from time to time.

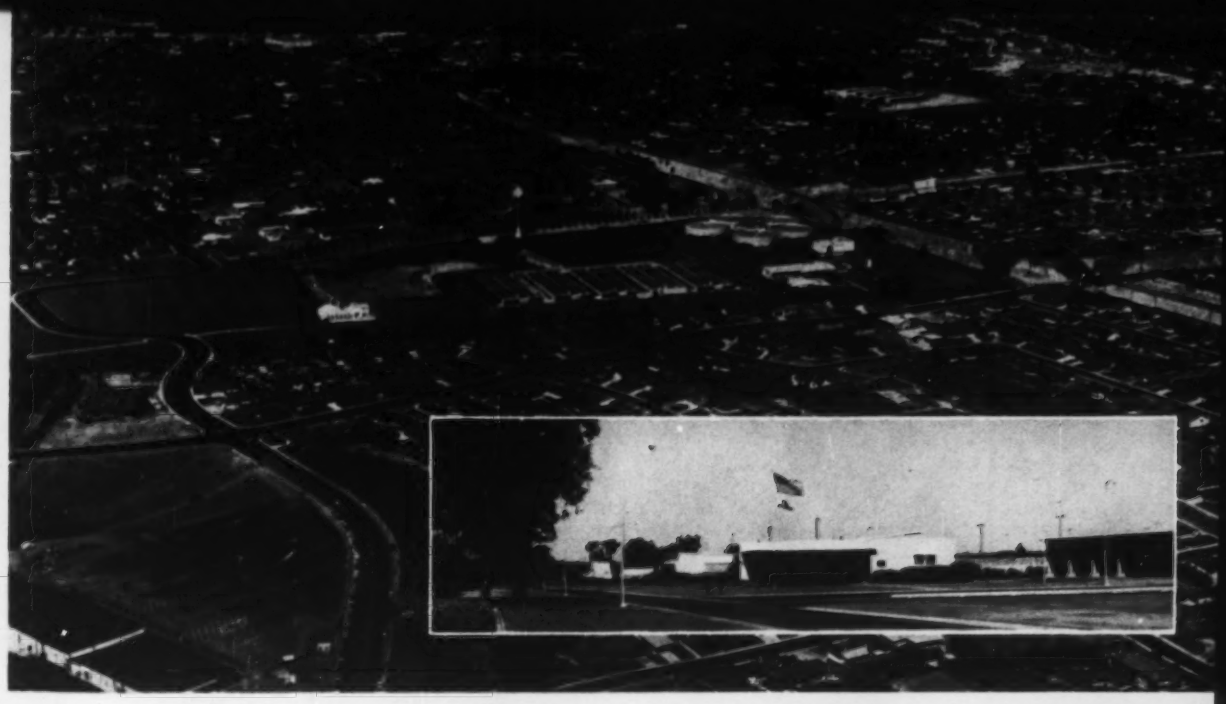
3. Safety, comfort and convenience must be considered as well as conformity with the rigid building codes of the State of Pennsylvania.

With these requirements before them, the University Planning Board decided that steel deck construction would economically provide permanence for the present and mobility and expandability for the future.

In August 1934, Penn State contracted with the Pittsburgh-Des Moines Steel Company for the fabrication and erection of the first structure, involving 20 rows of seats 180 ft long. A total of 85 tons of steel deck plates, structural girders, columns, and handrail made up this original installation, which seated 2,400 people.

Within the next five years, four contracts were awarded for the fabrication and erection of additional steel-deck grandstand sections, and by 1939 the facility had grown to 16,400 seats, consisting of two 40-row sections each 306 ft long. An addition of 13,000 seats was erected in 1948, bringing the seating capacity to 30,000. The following year the four-story welded-steel press box was installed, complete with structural tower support, walkways, and stairways, amounting to 93 tons of new steel. See Table I.

The Penn State type of unitized construction has proved capable of fulfilling the combined requirements of permanence, mobility, safety and security with economy. Moreover, following each expansion project, the stadium has had an attractive appearance of completeness, with none of the patchwork effect common to other types of construction. Plans call for still further expansion by the addition of 10 more rows around the end and on the two sides, which will increase the total capacity to over 50,000 seats. This type of unitized construction can be expanded almost indefinitely.



Only six years after its construction in a relatively undeveloped region, Sacramento's Sewage Treatment Plant is completely surrounded by high-quality residential areas. Landscaping and odor control for the sewage treatment plant make surrounding area suitable for development.

Reducing sewage plant odors in a residential area

W. S. HYDE, M. ASCE, Supervising Engineer, Division of Water and Sewers, City of Sacramento, Calif.

The "mid-fifty spread" has caught up with many communities, and California's state capital, Sacramento, is among them. A mushrooming residential growth has enveloped a major waste treatment facility, which was completed in 1954.

Necessity has forced a detailed review of the factors that cause conflicts between the community interests of needed waste disposal on the one hand, and residential land use on the other. The most important of these conflicts has been caused by odors inherent in sewage plant operation.

The treatment plant provides primary treatment at a nominal capacity of about 75 mgd for a service area of some quarter of a million people. Five major food processing plants are heavy contributors during the canning season, and raise the biochemical oxygen demand to a population equivalent of about three-quarters of a million during August and September. Plant effluent is discharged to the Sacramento River. Chlorine is applied to the effluent during the period of recreational use of the river—generally May through October. Prechlorination, however, is maintained throughout the year for odor control.

The primary purpose of sewage chlorination in California is generally a reduction in bacterial population of plant effluent through post-chlorination. This requirement has been established, and enforced, by health or pollution-control agencies in protecting benefits for downstream users. Prechlorination, as a means of reducing odors and improving plant "housekeeping," is an intangible benefit for which operating funds have not usually been provided. The feeling has been that odors are a necessary evil and simply a part of the treatment processes.

Sacramento's last annual budget included $52,000 for the purchase of 720 tons of chlorine. While some 70 tons were utilized for coliform control by post-chlorination, the bulk of the chlorine, 650 tons, was applied primarily for odor control at the headworks.

Odor-causing sources

Like the solution to most problems, effective control of air pollution created by a sewage treatment plant is in part a matter of care in design and in part a matter of patient, detailed investigation and correction of odor-causing sources. In the approximate order of their occurrence, consideration will be given to the remedial measures taken to correct odor nuisances as they developed during the start-up of the Sacramento plant.

Sewage is pumped to the treatment plant through nearly two miles of force main. The hydrogen sulfide content rises from about 0.2 ppm at the pumping station to about 0.7 ppm by the

time it is discharged at the plant headworks. Between the point of chlorine application at the headworks and the free water surface, there was only some 14 ft of water travel in which to achieve thorough mixing. This allowed rather limited contact, and lack of adequate diffusion resulted in significant release of hydrogen sulfide at the influent structure—the major odor problem.

The chlorine solution diffusor was redesigned, and a slowly rotating paddle-type mixer was installed to achieve homogeneity in the application of the prechlorination dosage. The level of chlorine dosage during dry-weather flow averages 10 ppm, and now gives completely satisfactory control of sulfides. Aside from providing odor control, this pretreatment of course reduces the chlorine dosage required for effluent treatment to reduce bacterial content.

Another major source of odor production occurred at the sludge pumping building. Sludge is transferred from the individual sedimentation basins to a collecting sump in this structure, from which it is repumped to the digesters. The incoming sludge lines have a free discharge, well above the liquid surface in the sump, to allow the operator visual and sampling control on the duration of sludge transfer. Such free discharge results in the evolution of hydrogen sulfide. The sludge pumping building also contains the blowers supplying air for pre-aeration, and this offered a convenient solution to the odor problem. The blowers were repiped so as to take their suction from the area above the collecting sump. The evolved gases, together with air, are applied at the point of pre-aeration, and hydrogen sulfide is returned to solution where it is neutralized by chlorine available within the sewage. It may be of interest to note that examination of the blowers indicates that no corrosion damage due to hydrogen sulfide has occurred.

The third problem resulted from slow start-up of the digestion process. The digesters were initially placed in operation without any seeding with ripe sludge. The gas produced had to be wasted, but was low in methane and would not burn. This discharge is quite malodorous. After several weeks, 100,000 gal of well-seeded sludge were hauled in from the City of Stockton, and an immediate improvement in the digesters was noted.

"Good housekeeping" important

After the major difficulties experienced during the initial operation of the plant were overcome, the primary need has been the persistent application of "good housekeeping" practices. The level of odor complaints from nearby residents is now very low—about six during the course of a year. Each of these is investigated and a report made back to the complainant. In many cases, the odors have been traceable to sources other than the treatment plant itself; for example, canneries odors, or odors due to nearby sewage lift stations.

Esthetic considerations

A successful real estate salesman has commented that, "The art of real estate selling is to present the truth attractively." This applies no less to the engineering profession if its products are to be packaged so as to give them social acceptance. The community nose is less likely to be irritated if the treatment plant is otherwise esthetically pleasing. Design and landscaping features of the Sacramento plant are shown in accompanying photographs. In the photos the concern given to landscape care is evident. Gardening services, performed by the City Recreation and Parks Department, involve an annual expense of $19,000.

It would probably be impossible to place a facility such as the Sacramento plant in an area that was already highly developed. However, the existence of such a facility is no bar to adjacent high-quality residential growth—provided the esthetic standards of the community are not offended. As a measure of the degree to which this "coexistence" has been successful, the assessed valuation of the property lying within 1,500 ft of the plant exceeds 4½ million dollars. This represents a market value of about 13 million dollars. Within this area the market value of individual residential lots ranges from 3,000 to 9,000, and that of homes from $10,000 to $55,000.

Sewage treatment plants located within residential areas represent an extreme in adjacent land use. This cannot be achieved without certain costs. Aside from those mentioned, an unavoidable cost is competent, technically qualified plant personnel.

The sanitary engineering profession will not only short-change itself but will invite deserved criticism if it ignores esthetic values—among them, proper odor control—in the design and operation of sewage treatment facilities. If these values are observed, at least the development of adjacent values, both "assessable" and "social," will not be inhibited. Sacramento's sewage treatment facility is an interesting illustration of this point.

(This article was originally presented by Mr. Hyde as a paper at the ASCE Reno Convention, before the Air Pollution session of the Sanitary Engineering Division.)

Estimating

In foundation work it is at times desirable to estimate the relative density of sands from data obtained in exploratory borings. This problem has received attention; the most nearly definite work is that of Holtz and Gibbs[1] using the standard penetration test.[2] In that work, the authors investigated the test effects of such variables as the size, length and weight of drill rod, moisture content, vertical pressure and relative density for coarse and fine sands. They concluded that of these, relative density and vertical (or overburden) pressure were the principal variables. In their Fig. 7, they presented curves relating these to blow counts from the penetration test. These curves, considered by their authors to be conservatively reliable in most sands, are the subject of this article.

In using the curves published by Holtz and Gibbs, it is usually necessary to interpolate vertical pressures. This is awkward in routine work and can be a problem in correlation tests, in cases where all three variables are measured to determine the validity of the relationship for a particular sand. The writer has found that the accompanying graph, Fig. 1, simplifies this problem. The relation shown is an interpolation of the curves published by Holtz and Gibbs.

Interestingly enough, on this type of plot, lines of equal relative density are straight, by induction, and they essentially intersect at a point, especially in the higher density range. In this range, from about 65 to 95 percent relative density, the fit is rather good and best satisfies other checks. From this, one could speculate on the accuracy of destructive density tests in cohesionless sands at low and very high densities. Fortunately, the range that best fits the data is also the range that is usually of most interest.

Others may find the accompanying graph, Fig. 1, helpful. The following equation expresses a part of the graph reasonably well:

the relative density of sands

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$$RD_{65\ to\ 95} = 40 + 7.19\sqrt{\frac{7.36\,(N-2.4)}{P+1.36}} - 17.9$$

where

$RD_{65\ to\ 95}$ = relative density, in percent, between 65 and 95 percent

N = number of blows per foot, from standard penetration test

P = vertical pressure, kips per sq ft

Those who refuse to be intimidated by the accuracy or sensitivity of the penetration test should round out their answers to the nearest whole percent in using this equation.

For anyone interested, the writer recommends correlation tests on sensitive projects and in materials that are essentially fine sands. Such tests should validate or determine the relationships of the three variables here discussed. In that connection, more reliable results may be expected from such comparisons if:

1. Penetration blow counts are higher than eight.

2. In-place density tests are carefully taken at depth.

3. The sand-cone density test,[3] with a base plate, is used and test-hole volumes are larger than 0.075 cu ft.

The trend of the curves on the accompanying graph, Fig. 1, is interesting. As shown, they intersect at 2.4 blows and −1.36 kips per sq ft. In consideration of test accuracies, permeabilities and volume changes with shear, it is not difficult to theorize a shift of their intersection point to the vertical-pressure axis. From the relation shown, this point should occur at about atmospheric pressure (minus on the scale shown) or zero, absolute pressure. If true, this would be a rather elegant confirmation of the strength theory for cohesionless materials *under effectively instantaneous loading*. It predicts that at zero absolute pressure, the impact tests performed by Holtz and Gibbs would have given a zero blow count regardless of the relative density of the sand.

This should not be difficult to prove, or disprove, experimentally—given suitable equipment. It would be necessary to place the test system in a high vacuum and perform the standard penetration test. Best results would be expected from dry sand. If wet sand were used, complications could be expected due to surface tension and permeability. However, these probably would not be measurable in the test.

At first glance this theory may seem of academic interest only. However, today things "out of this world" are no longer so remote. For example, the exposed surface of the moon apparently consists of particles averaging in size between those of clay and large gravel, and the presence of deep dust-filled depressions is expected.[4] These conditions are presumably the result of meteorite collisions.

We will be making hard landings of instrumented payloads on the moon's surface soon. The possibility of hitting such a depression will have to be considered, and the implications of the relations discussed above are not reassuring. The first landings on the moon—with its lack of atmosphere, low gravity and its depressions probably filled as suggested—might well seem to be on "green cheese," and very soft cheese at that.

References

[1] Holtz, W. G., and Gibbs, H. J., "Research on Determining Density of Sands by Spoon Penetration Testing," *Proceedings, Fourth International Conference on Soil Mechanics and Foundation Engineering*, vol. 1, 1957, pp. 35-39.

[2] "Penetration Test and Split-Barrel Sampling of Soils," ASTM Designation D 1586-58T.

[3] "Density of Soil in Place by the Sand Cone Method," ASTM Designation D 1556-58T.

[4] Jastrow, Robert, "The Exploration of the Moon," *Scientific American*, vol. 202, no. 5, May 1960.

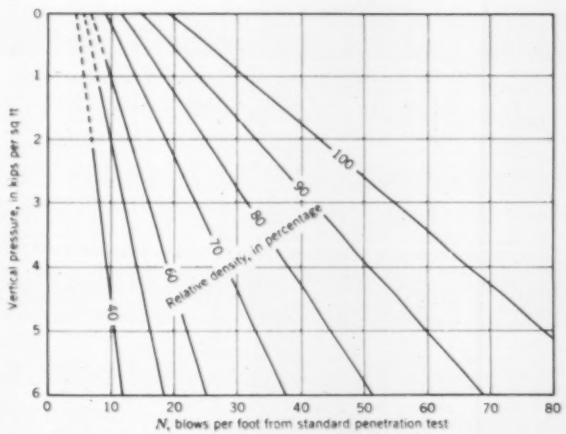


FIG. 1. Graph shows general relation between standard penetration, vertical pressure, and relative density for sands.

VeriKlag scale for stream-flow routing

DELMAR J. TAYLOR, Hydrologist, River Forecast Center, U. S. Department of Commerce, St. Louis, Mo.

Stream-flow routing is the hydrologic technique used to obtain the hydrograph of a flood wave at the downstream end of a river reach from the corresponding hydrograph at the upstream end. Routing can be accomplished analytically, graphically, or with the aid of electronic or mechanical analogs. One such aid is a calibrated straight-edge devised to facilitate lag routing by use of the variable K, as described by M. A. Kohler in his paper, "Mechanical Analogs Aid Graphical Flood Routing," in the April 1958 *Proceedings* of the Hydraulics Division, ASCE.

In brief, the method is based on a variation of the Muskingum equation,

$$\frac{dO}{dt} = \frac{I\text{-}O}{K}$$

with the x factor equal to zero, that is, under pure reservoir action. In this equation O is a point on the outflow hydrograph and I is a point on the inflow hydrograph. The condition of pure reservoir action can be approximated by regarding the x factor as a translatory component of wave motion, and lagging the inflow hydrograph according to the following relationship of lag versus inflow.

The time difference between the outflow crest and the corresponding discharge value on the receding limb of the inflow hydrograph is the lag value T_L appropriate to that inflow. A plotting of the values of T_L thus obtained from previous rises is used to define a "lag curve," Fig. 1, throughout the range of observed inflow values.

At the outflow, O_2, Fig. 2, K is the time difference between the "time intercept" of O_2 and the intersection of the tangent to O_2 with a discharge value equal to I_2. The lagged inflow hydrograph is not shown in Fig. 2 because it is not used in routing; however it is helpful in defining the relationship of K versus outflow. The value of K can be determined at any point on the outflow hydrograph, and the values obtained from historical rises are plotted and used to define the K curve, Fig. 1.

The above lag and K curves, arranged as shown in Fig. 1, are converted to a corresponding scale by dropping verticals from selected discharge values on the curves to a horizontal base line. The calibrations defined by the verticals from the lag curve are labeled with the corresponding inflow values to obtain a lag scale, while a similar K scale derived in the same way is labeled with outflow values.

The resulting double scale, Fig. 1, bottom, with a common zero time index, designated T_o, is called a VeriKlag scale. (The term VeriKlag is a phonetic contraction of variable K and lag.) A working model of this double scale can be obtained by inscribing it on a transparent plastic straight-edge of suitable size. Since it can be used only with the time scale and in the reach for which it is developed, it should be appropriately labeled.

Operation of the VeriKlag scale will be described in terms of a segment on the inflow hydrograph, I_1-I_2, routed to a corresponding segment on the outflow hydrograph, O_1-O_2, as labeled in Fig. 2. The following steps are required:

1. Place the VeriKlag scale parallel

FIG. 1. Lag and K curves, at top, are converted to a corresponding double scale, bottom.

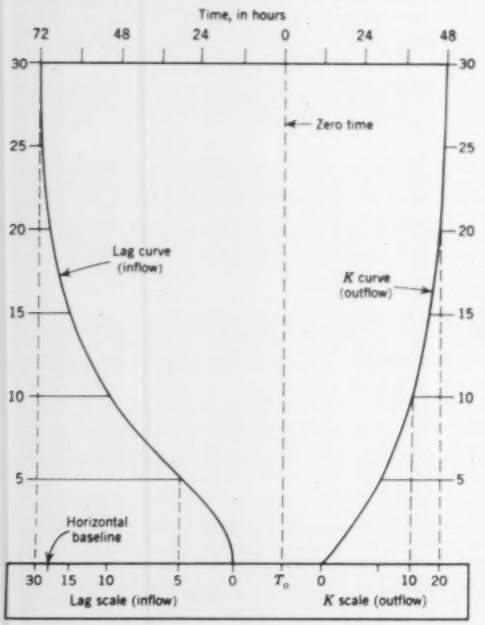
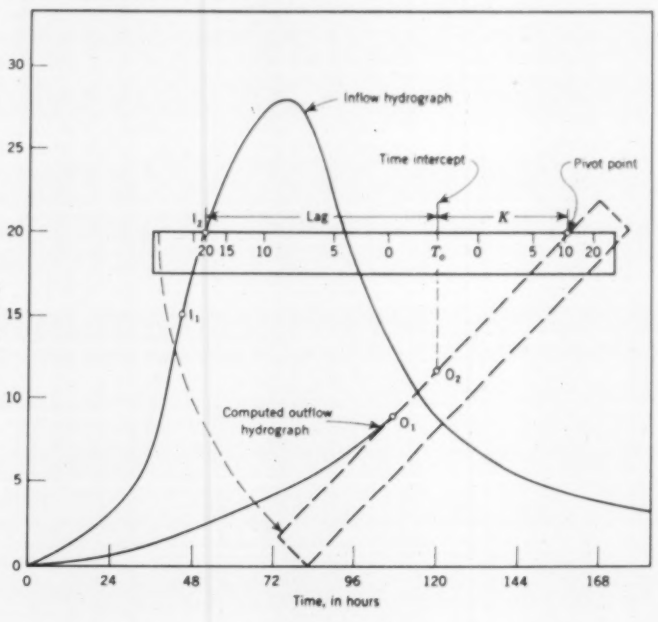


FIG. 2. Calibrated straight-edge is pivoted as shown by dotted lines to aid in obtaining stream-flow routing.



to the horizontal time axis of the hydrograph with the inflow value I positioned according to its corresponding value on the lag scale.

2. Make a pencil mark at T_0. This point denotes the time intercept of O_2.

3. Set the pencil point at a position (pivot point) on the K scale corresponding to a value of O_2, estimated by eye extrapolation from O_1.

4. Pivot the scale to intersect O_1. The intersection of the scale with the time intercept of Step 2 is the computed value of O_2. If that value differs substantially from the value estimated in Step 3, repeat Steps 3 and 4 using the computed value just obtained to locate the pivot point on the K scale.

A straight-edge calibrated in this fashion can be used throughout all ranges of flow in a given reach because it is independent of the discharge plotting scale used on the hydrograph. The distance between the computed points on the outflow hydrograph can be varied as required to adequately define its shape.

Spacing of vertical stirrups in beams

ANSELM CEFOLA, M. ASCE

Associate Professor of Engineering Drawing, The City College, New York, N. Y.

Spacing of vertical stirrups in the design of web reinforcement for reinforced concrete beams is based on the formula,

$$s = \frac{A_v f_v jd}{V'} \quad \text{or} \quad \frac{d}{V'} = \frac{s}{A_v f_v j}$$

where

A_v = total cross-sectional area of stirrup legs
d = effective depth of the beam
$j = 7/8$, usually
f_v = allowable tensile stress for the stirrup, 18,000 or 20,000 psi
V' = total shear for which beam is to be reinforced

With values given for these parameters, the size and spacing of the vertical stirrups can be very efficiently determined by using the accompanying proportionality chart, Fig. 1.

An example solved

Given: $V' = 100$ kips, $d = 60$ in., $f_v = 20$ kips per sq in.

It is required to find the size and spacing of the stirrups. The procedure consists of the following steps:

1. Draw line **ABC** through $d = 60$ and $V' = 100$.

2. Through **D**, at the assumed stirrup size with the given allowable stress, draw line **DBE.**

3. Point **E** gives the proper spacing, that is, No. 4 double-stirrup spaced at 8¼ in. or (by taking **D** at 4-No. 3) No. 3 double-stirrup spaced at 4½ in.

4. If it is desirable to change the spacing of the stirrups from the minimum given in Step 3 to values of S such as 10, 15, or 20 in., etc., or to $d/2$, the chart, Fig. 2, will give the corresponding values of V'. These values, when plotted on the total-shear curve, will yield the distance from the end of the beam at which the spacing may be changed.

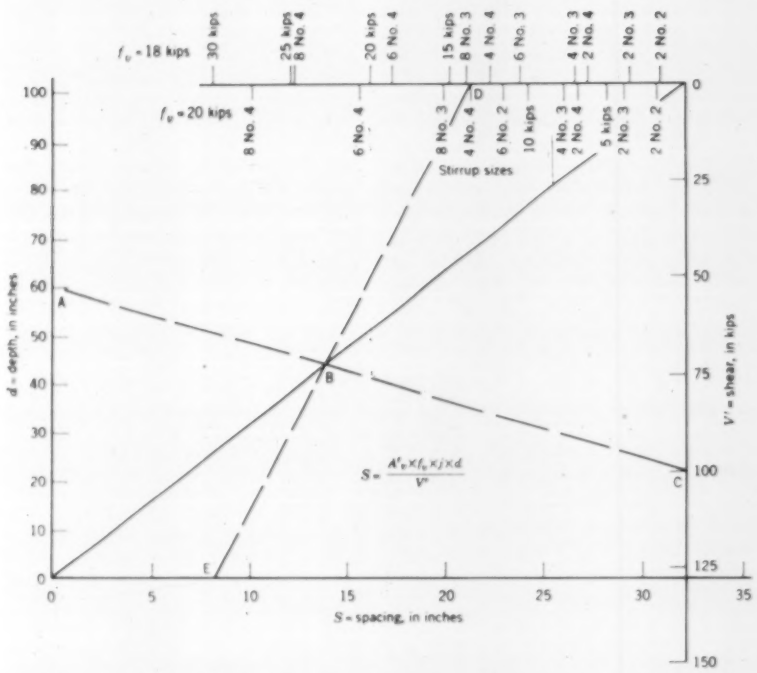


FIG. 1. Proportionality chart gives size and spacing of vertical stirrups when other values are known. See example in text.

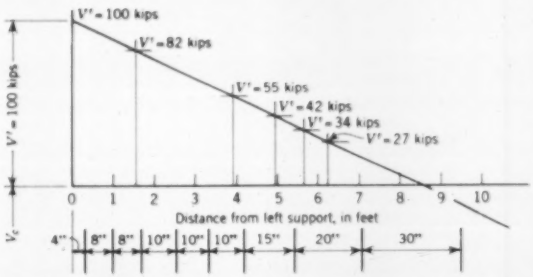


FIG. 2. Partial shear diagram gives curve of total shear for determining distances from the end of the beam at which the stirrup spacing may be changed. Figure shows solution to example as nine No. 4 double stirrups spaced as follows: one at 4 in., two at 8 in., three at 10 in., and one each at 15 in., 20 in., and 30 in.

Apparatus shows critical velocities in pipe flow

J. W. FORTEY, F. ASCE, Visiting Lecturer
Department of Civil Engineering, Rice University, Houston, Tex.

It would be difficult to overemphasize the importance of the Reynolds number in the realm of fluid mechanics. Consideration of this parameter forms an essential part of an undergraduate course, and probably the most usual and convenient experimental study is concerned with the viscous flow of a liquid through a suitable tube.

For the purpose of undergraduate laboratory experiment the apparatus shown in Fig. 1 was constructed and has been in use at the Rice University for some time. The apparatus is simple in design and was constructed at a very low cost by the laboratory staff of the Engineering Department. It has proved to be very reliable, the upper and lower critical velocities being extremely well defined, both as the velocity is increased and as it is decreased. Although the apparatus is at present used with water at room temperature, it can be modified slightly to operate at other temperatures and with other liquids.

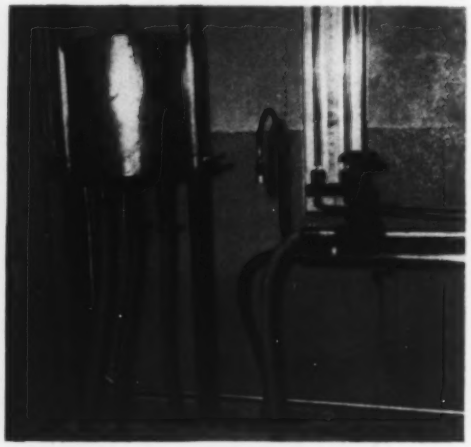
The test pipe is commercial copper tube, nominally ⅜ in. in diameter. It was found convenient to keep the apparatus self contained, with the pump at one end of the horizontal test pipe. For this reason the copper pipe of 1½-in. diameter forms a convenient support for the light pipe while also acting as the supply conduit. The converging nozzle connects the large pipe to the test length and provides steady flow conditions. Space considerations limited the actual test length to 15 ft but this has proved to be quite adequate.

The unusual feature of the installation is the variable-head tank. In the writer's experience similar apparatus, using a valve to control the flow, has not proved sufficiently sensitive for optimum results. Although the variable-head tank is more complicated, the flow is infinitely adjustable and the extra expense has proved to be fully justified. As will be seen from Fig. 1, the pump maintains a constant level in the adjustable tank. By altering the height of the tank the velocity of flow can be varied as desired.

Discharge is collected in a graduated measure, and the small capacity of the apparatus allows a large number of readings to be made in a comparatively short time. A typical graph is reproduced in Fig. 2, showing the well-defined critical points. The manometer fluctuations characteristic of the transition regime are very noticeable and provide direct visual evidence of the complex flow at this stage.

In its present arrangement the unit can be used for different liquids. By enclosing the pipes in a water bath it is hoped to investigate the effect of small temperature variations.

Since much of the apparatus was already available, the cost of the Rice University unit is difficult to estimate. However, because of the small scale of the unit, the overall cost of duplicating it should not exceed a few hundred dollars.



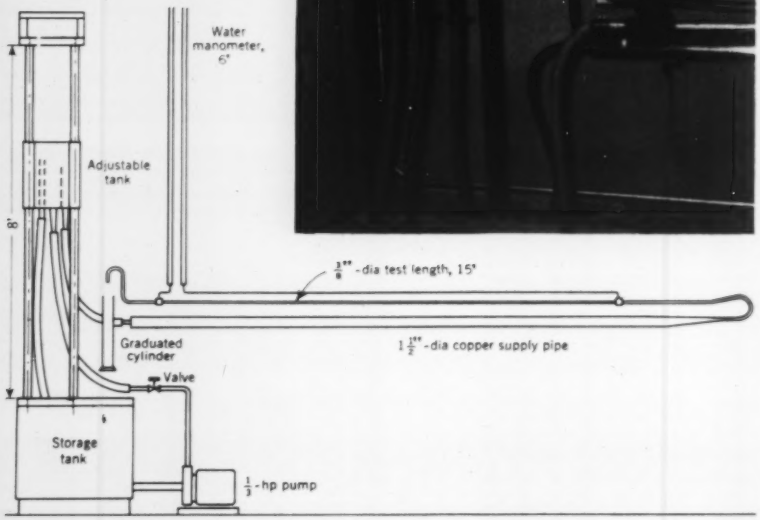


FIG. 1. Simple apparatus is used at Rice University for the study of critical velocities in pipe flow.

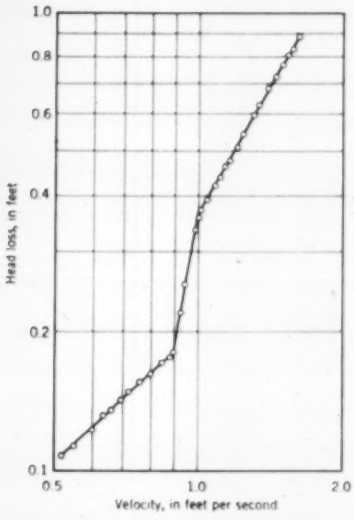


FIG. 2. Typical graph shows well-defined critical points in pipe-flow velocities.

ASCE NEWS

Nine New Officers to Be Installed During Convention

Glenn W. Holcomb

Glenn W. Holcomb, who will take office in October as the 92nd President of the Society, is a former Director and Vice President of ASCE and widely known as an engineering educator. He is chairman of the civil engineering department at Oregon State College, Corvallis.

Professor Holcomb has been on the staff at Oregon State College since 1920, advancing through the various positions from instructor in civil engineering to head of the department. His work there has included teaching extension courses for professional engineers throughout the state. He has also been active in arousing the interest of engineers and contractors in the value of education and research to their work.

A civil engineering graduate of the University of Michigan in 1919, he received his M.S. in education from Oregon State College in 1931. In 1917 and 1918 he was in the Engineers' Reserve Corps of the Army, assigned to duty at the University of Michigan, for part of the period as instructor in surveying and mapping.

Professor Holcomb has many professional and civic interests. During World War II he was director of Engineering, Science, Management, War Training for Oregon. He is currently a member of the Board of Engineering Examiners for Oregon, the American Society for Engineering Education, the American Concrete Institute, the Professional Engineers of Oregon, and the American Association of University Professors. He has also served on the Corvallis City Council. He is author of a number of engineering manuals and of engineering personnel and aptitude studies.

GLENN W. HOLCOMB
President-Elect of ASCE

Professor Holcomb was ASCE Director for District 12 from 1953 to 1955, and Vice President for Zone IV in 1956 and 1957. He has served the Society in many committee capacities, and is currently a member of the Committee on Convention Policy and Practice.

In his early career Mr. Mattern was in the Operating Department of the Consumers Power Company (Michigan) for five years. In this work he helped considerably in the development of the Index Method of hydraulic turbine testing. He was also with J. Paul Blundon, consulting engineer of Keyser, W. Va. A 1926 graduate of Pennsylvania State University, Mr. Mattern was graduate assistant in civil engineering at Iowa State University from 1926 to 1928 while working for a master's degree in hydraulic power. He also holds the professional degree of C.E. from Iowa State, and is a licensed professional engineer in his home state of Tennessee.

Long active in ASCE, Mr. Mattern is currently completing a three-year term as Director for District 10. He has been chairman of the Committee on Salaries and is now Board Contact Member on the Committee on Employment Conditions and on the Committee on Convention Policy and Practice (until 1964). He is also a member of the executive committee of the Committee on Conditions of Practice, and chairman of the Membership Qualifications Committee. At local level, Mr. Mattern has been president of the Tennessee Valley Section's Knoxville Branch (1949) and of the Section itself (1951). In 1949 he helped establish the District 10 Council. He was managing editor of the "Tennessee Valley Engineer" in 1950 and 1951, and later served on its board of editors. Mr. Mattern was also general chairman of the Society's Summer Convention, held in Knoxville in June 1956.

Donald H. Mattern

Donald H. Mattern, chief of the Project Planning Branch of the Tennessee Valley Authority, Knoxville, Tenn., and new Society Vice President for Zone II, has been prominently identified with the TVA since its early days. From 1934 to 1938 he was in the Design Division engaged chiefly in hydraulic turbine test work. For part of this period he was also assistant to the chief design engineer. Since 1938 he has been in the Project Planning Branch of the Division of Water Control Planning. As chief of the Branch, he is currently responsible for preliminary investigations and economic studies for all multiple-purpose hydro and steam-electric generating developments.

DONALD H. MATTERN
Vice President, Zone II

William J. Hedley

William J. Hedley, new Vice President for Zone III, is chief engineer of the Wabash Railroad, St. Louis, and a resident of Clayton, Mo. He is a 1925 graduate of Washington University with the degree of bachelor of science in civil engineering, and in 1953 he received the professional degree of civil engineer there. After a brief period with the Mississippi Valley Structural Steel Co., he began his career in the engineering department of the Wabash Railroad, which he has served as draftsman, bridge inspector, resident engineer, bridge designer, assistant engineer, construction engineer, and assistant chief engineer. He has been chief engineer since 1957.

Mr. Hedley was admitted to member-

WILLIAM J. HEDLEY
Vice President, Zone III

ROGER H. GILMAN
Director, District 1

HENRY W. BUCK
Director, District 2

ship in ASCE in 1939 and served as Director for District 14 from 1956 through 1959. He has been president of the St. Louis Section; Contact Member for the Student Chapter at Washington University; a member of the Advisory Committee on Exhibits for the Centennial of Engineering; and chairman of the Technical Program Committee of the St. Louis Convention in 1955. He is currently a member of the Committee on Convention Policy and Practice, the City Planning Division Committee on Planning Terminology, the ASCE-AIP Joint Cooperative Committee, and the EJC National Transportation Policy Panel.

He is a past president of the American Railway Engineering Association, the Engineers Club of St. Louis, the Joint Council of Associated Engineering Societies of St. Louis, and the Mississippi Valley Maintenance of Way Club. He is also a member of the Committee on Grade Crossings and the Committee on Waterway Projects of the Association of American Railroads. Mr. Hedley has served as vice chairman of the commission that drafted a new charter for the City of Clayton in 1957. He is now chairman of the Clayton City Plan Commission and a member of the St. Louis County Planning Commission. He is the author of several treatises on railway-highway grade crossing protection which have received wide recognition.

Roger H. Gilman

The recently elected Director for District 1 is Roger H. Gilman, of Plainfield, N. J. As director of port development for the Port of New York Authority, Mr. Gilman is responsible for the planning of new transportation and terminal facilities (other than aviation) for the New York-New Jersey Port District and for the promotion and protection of commerce moving through the Port of New York.

Mr. Gilman received his A.B. in engineering sciences from Harvard College, then attended the Harvard Bureau for Street Traffic Research. In 1937, he joined the Port Authority as a statistician-economist. Following four years' service with the U.S. Navy, he returned to the Port Authority in 1945 as assistant to the director of port development, becoming director in 1953.

Long active in ASCE, Mr. Gilman has been chairman and secretary of the executive committee of the Waterways and Harbors Division and has served on the Annual Convention Committee. At present he is on the Society's Committee on Professional Practice and a member of the Local Qualifications Committee (District 1). He has also been active in the Metropolitan Section, which he has served as president.

At the present time he is chairman of the Committee on Harbors and Shipping of the American Association of Port Authorities. Among his other affiliations are the Committee on Foreign Commerce and Affairs of the New York Chamber of Commerce, the Maritime Research Advisory Committee of the National Academy of Sciences-National Research Council, and the Rivers and Harbors Committee of the Newark Association of Commerce and Industry. He is also on the Civil Engineering Advisory Committee to the Board of Trustees of the Newark College of Engineering.

Henry W. Buck

The Director-elect for District 2 is Henry W. Buck, senior partner in the Hartford (Conn.) firm of Buck & Buck. Mr. Buck, a 1925 graduate of Yale University, was employed from then until 1930 by Dwight P. Robinson & Company on construction projects in New York City, Seville, Spain, and Rio de Janeiro, Brazil. He then returned to his native Hartford to become associated with his father, Henry R. Buck, a Director of ASCE, until his death in 1934. He has continued a general civil engineering practice since that time—in association with his brother, Robinson D. Buck, from 1938 until his death in 1959, and now with his cousin, Richard S. Buck. He taught civil engineering classes at Trinity College in 1932 and 1938, and since 1945 has been a member of Technical Planning Associates of New Haven.

Mr. Buck has been continuously associated with the Society since his membership in the Yale University Student Chapter. He has been active in the affairs of the Connecticut Section, which he has served as president and as a member of numerous committees. He represented the Section as a delegate to the Connecticut Technical Council and served as its chairman. For many years he was adviser to the Student Chapter at the University of Connecticut.

Among his other affiliations are the American Institute of Consulting Engineers, the National Society of Professional Engineers, and the Connecticut Society of Civil Engineers, which he has served as president.

Earle T. Andrews

Earle T. Andrews, of Berkeley Springs, W. Va., is new ASCE Director for District 6. Since 1927 he has been connected with the Pennsylvania Glass Sand Corporation and its subsidiary companies and is currently vice president. The corporation, which has its headquarters at Hancock, W. Va., is active in the field of non-metallic minerals. In his long connection with it, Mr. Andrews has been responsible for the design and construction of facilities and engineering projects totaling over $100,000,000. One of his major achievements was the design and construction of the largest and most fully automatic silica mining and processing plant in the world, a $25,000,000 project.

EARLE T. ANDREWS
Director, District 6

JOHN B. SCALZI
Director, District 9

JOHN D. WATSON
Director, District 10

Mr. Andrews was educated at the U.S. Naval Academy and at Washington and Lee University. In his early career he was resident engineer for F. R. Sweeny & Co., of Anderson, S. C.; construction engineer for W. B. Simpson, of Huntingdon, Pa.; and design and construction engineer for W. D. Steinbach Sons, general contractors of Lewiston, Pa.

He has served as a consultant to various organizations and government agencies. He is currently advising on a proposed sewerage project for the City of Berkeley Springs and is the engineer member of the Sanitary Board for the city. He is also the West Virginia member of the advisory board to the U.S. Corps of Engineers on water resources studies of the Potomac River Basin.

One of Mr. Andrews' numerous important services for the West Virginia Section was the energetic conduct of its fund-raising campaign for the United Engineering Center, which went over the top early in the drive. He has also served the Section as president. His many other affiliations include the West Virginia Society of Professional Engineers, which he is currently serving as president.

John B. Scalzi

John B. Scalzi, the new Director for District 9, has had a versatile career, combining engineering teaching and consulting work. For most of the past fifteen years he has been on the engineering faculty of the Case Institute of Technology at Cleveland—first as assistant professor of structural engineering, and from September 1951 to June 1960 as associate professor of structural engineering. In July 1960 Dr. Scalzi joined the United States Steel Corporation as a member of the Construction Section of the Market Development Division, with headquarters in Cleveland.

During the 1950-1951 academic year he was on leave of absence from Case to attend Massachusetts Institute of Technology as research engineer under a grant from the Welding Research Council to study the behavior of intermittent welds on structural members. This research was reported in his doctoral thesis in 1951. He is a 1938 graduate of Worcester Polytechnic Institute and received the S.M. in C.E. from M.I.T. in 1940. Concurrently with his work at Case, Dr. Scalzi also lectured in the School of Architecture at Western Reserve University.

His professional experience also includes five years (1940 to 1945) as stress analyst to the senior structures engineer at the Curtiss-Wright Corporation, Buffalo, N. Y., and a year as design engineer for the National Airline Division at Buffalo. Summers over the years he has been employed as consultant to a number of prominent Cleveland firms. From 1952 to 1957 he also prepared and graded the examinations for registration of professional engineers in the state of Ohio.

Long active in ASCE, Dr. Scalzi has served on a number of its technical committees and was chairman of the technical program for the Society's Cleveland Convention in the spring of 1959. At local level, he has been president of the Cleveland Section and is now serving a five-year term on the Board of Directors. He has also held office in the Cleveland Society of Professional Engineers, the American Association of University Professors, and the Institute of Aeronautical Sciences. His numerous publications include a recent CIVIL ENGINEERING article.

John D. Watson

John D. Watson, a consulting engineer of Greensboro, N. C., will represent District 10 on the new Board of Direction. Educated at the University of North Carolina and at Harvard University, Dr. Watson was associate professor of civil engineering at the University of North Carolina and at Duke University in the years before the war. He then served for several years as chief engineer for the J. A. Jones Construction Company, of Charlotte, N. C.

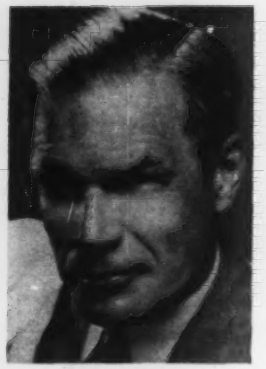
Since 1945 he has been in general engineering practice in North Carolina, and is now principal partner in the Greensboro firm of Watson Engineers. Recent important projects of his firm include the complete design of the installation of the largest high-speed fine paper machine in the world for the Champion Paper and Fibre Company at Canton, N. C. He is a registered professional engineer in North Carolina, South Carolina, Virginia, New York, and Florida.

Dr. Watson's interest in ASCE goes back to his undergraduate days at the University of North Carolina, where he was president of the Student Chapter in 1928. He has served the North Carolina Section as vice president and president, and is currently on its Local Qualifications Committee. He was also Section delegate to the organizational meeting of the District 10 Council at Chattanooga.

His other affiliations include the North Carolina Society of Engineers, which he has served as director, vice president, and president. He was a charter member of the Professional Engineers of North Carolina, and is now vice chairman of the North Carolina Board of Registration for Professional Engineers and Land Surveyors.

Harmer E. Davis

The new ASCE Director for District 11 is Harmer E. Davis, who is widely known as originator and director of the University of California's Institute of Transportation and Traffic Engineering at Berkeley. A graduate of the University of California (B.S. in 1928 and M.S. in civil engineering in 1930), Professor Davis has been on the civil engineering faculty



HARMER E. DAVIS
Director, District 11

there since 1930. While progressing through the various academic ranks, he conducted many special engineering studies and served as a research engineer in the Engineering Materials Laboratory. He is currently professor of civil engineering as well as head of the Institute of Transportation and Traffic Engineering.

In 1948 Professor Davis was called upon to begin the development of the Institute, and the following year was asked to undertake the continuing statewide direction of the important research and educational agency. From 1948 to 1954 he also served as chairman of the Division of Transportation Engineering, and from 1954 to 1959 as chairman of the Department of Civil Engineering at Berkeley. Numerous papers, reports and books attest to his busy and productive professional life—first, in the field of engineering materials and structures, and, in recent years, in transportation.

Long active in ASCE, Professor Davis has served it in such capacities as member and chairman of the executive committee of the Highway Division. He has also been on the Board of the San Francisco Section, and was Section president in 1959. In addition to his work on the Society's technical committees, he has been active in committee work for the American Society for Testing Materials, the American Concrete Institute, the Highway Research Board, and various other technical societies.

Various honors and awards bestowed upon him include: the San Francisco Section's Junior Membership Award, 1928; the Wason Medal (with R. E. Davis), of the American Concrete Institute, 1931; the Salzberg Medal of the Syracuse University Transportation Conference, 1952; chairman, Highway Research Board of the National Research Council, 1959; and the Roy W. Crum Distinguished Service Award (for accomplishment in the field of highway research), 1959.

GUY F. ATKINSON
Hon. M. ASCE

Four Elected to Honorary Membership

Guy F. Atkinson

Recently elected Honorary Member Guy F. Atkinson, chairman of the board of the Guy F. Atkinson Company, San Francisco, has to his credit almost 70 years of activity in major heavy-construction enterprises in the West. Representing the fifth generation in a long line of construction contractors, Mr. Atkinson left school at the age of 16 to enter the family business. At 21 he became a full partner in the firm doing building work—with headquarters first in Nebraska and later at Colorado Springs, Colo.

Since 1902 Mr. Atkinson has been in the construction business for himself—first in partnership with his brother Walter on projects in Oklahoma, Colorado, and Wyoming, and later as head of the Southwestern Construction Company, on early highway projects in California. He entered the construction field in his own name in 1918, moving to Portland, Ore., where he took part in a big highway program and, later, built Pardee Dam.

In 1929 the firm was expanded into the present Guy F. Atkinson Company. Under Mr. Atkinson's guidance the company has become a leader in the world construction industry. Either individually or as joint venturers, it has completed several hundred contracts totaling over $1,750,000,000. Among these are Grand Coulee Dam, Hansen Dam, the Bonneville Power Project, Mud Mountain Dam, Denison Dam, Harlan Dam, Pine Flat Dam, Ross Powerhouse, McNary Dam and Powerhouse, Treasure Island for the San Francisco World's Fair, the Roosevelt Naval Base, Army bases in the Aleutians, highway and railroad work in Greece, air bases on Okinawa, and the Hanford (Wash.) atomic energy plant. The company's more recent projects include the Dalles Dam on the Oregon-Washington border and Sakuma Dam in Japan.

Despite his 85 years, Mr. Atkinson remains active and continues his regular schedule of visits to construction projects being handled by his firm. Prominently identified with the Associated General Contractors of America, Mr. Atkinson served it as president in 1939, and for many years has been active in its heavy construction division. The many honors accorded Mr. Atkinson for his construction achievements include both The Moles 1956 non-member award and The Beavers first Management Award, also given in 1956. And despite his lack of formal education, he holds the honorary degree of Doctor of Engineering from Willamette University.

Solomon C. Hollister

Though newly elected Honorary Member Solomon C. Hollister has an international reputation as an engineering educator, he is also widely known for his researches in concrete and reinforced concrete and for numerous other achievements and activities. Associated with Cornell University since 1934, when he became director of its School of Civil Engineering, he has been dean of the College of Engineering since 1937.

He was educated at Washington State College and at the University of Wisconsin, receiving a B.S. in C.E. degree in 1916 and the C.E. degree in 1932. He also holds several honorary degrees. As an instructor in mechanics at the University of Illinois in 1916, he first became interested in reinforced concrete construction—an interest that has continued throughout his career. During World War I he was chief design engineer and head of the research branch of the Concrete Ship Section of the U. S. Shipping Board. Again, in World War II, he was advisory engineer to the Maritime Commission on its program of concrete ship production. From 1918 to 1940 he was chairman of the Subcommittee on Design of the Joint Committee on Standard Specifications for Concrete and Reinforced Concrete. His long affiliation with the American

SOLOMON C. HOLLISTER
Hon. M. ASCE

Concrete Institute includes seventeen years as director and two terms as president as well as many technical committee assignments. He also holds the Wason Medal of the ACI.

As a consulting engineer in Philadelphia during the 1920's, Dean Hollister became interested in the potentialities of structural welding. This interest, in turn, led him back to the academic scene in 1930 when he was appointed professor of structural engineering and assistant director of the Testing Materials Laboratory at Purdue. His work on photoelastic methods of analysis brought about his appointment as consulting engineer to Babcock and Wilcox on the design and fabrication of the Hoover Dam welded penstocks, and on a number of the company's other major projects. During this period he also conducted research on the transit mixer which became the basis for modern concrete mixing specifications.

In his long association with Cornell, he has devoted much time to educational developments, particularly the relation of engineering education to the profession. Through enthusiastic support of alumni and colleagues, the construction of an entirely new engineering campus with eight major buildings has been accomplished during Dean Hollister's tenure at Cornell.

Dean Hollister has filled many important committee assignments in the Engineers' Council for Professional Development. His long participation in the activities of the American Society for Engineering Education culminated in the presidency. In 1952 he was awarded the Lamme Medal of the ASEE bestowed annually upon a distinguished engineering educator. He has served as a member of numerous professional and public commissions including the Manpower Commission of Engineers Joint Council; the Committee on Specialized Personnel, Office of Defense Mobilization; the Advisory Committee on Engineering Sciences for Selective Service; and the Advisory Committee for the National Registry of Engineers and Scientists. He is currently chairman of the EJC-ECPD Committee on the Survey of the Profession.

Dean Hollister has been a member of ASCE throughout his professional career. He has served on the executive committee of its Structural Division and as Director for District 3. At local level he was the first president of the Indiana Section and has been president of the Ithaca Section.

Frank Kerekes

Frank Kerekes, new Honorary Member of ASCE and a distinguished engineering educator, is present dean of the faculty at Michigan College of Mining and Technology, Houghton, Mich. A native of Budapest, Hungary, he became a naturalized citizen of the United States in 1914. He did his undergraduate work at the College of the City of New York, receiving his Bachelor of Science degree in 1912. Following three years of graduate study, the degree of Civil Engineer was conferred on him by Columbia University in 1920.

From 1920 to 1954 Dean Kerekes was on the faculty of Iowa State University, where he rose to assistant dean of engineering before leaving to assume his present position. In addition to his work in education, he maintained a close relationship with the practical side of engineering by working summers with the New York Central Railroad and various architectural and engineering consulting firms.

Dean Kerekes has always been an enthusiastic researcher, his principal interest lying in the field of elastic behavior of reinforced concrete and steel structures as determined by actual field tests and model analysis. He is author or coauthor of three textbooks and some twenty technical papers or reports in the field.

Throughout his career, he has made signal contributions to the profession through working membership in the many technical and professional organizations to which he belongs. He served with distinction as the president of the American Concrete Institute in 1956-1957, as chairman of the Iowa Building Code Council from 1947 to 1949, and as president of the Iowa Engineering Society in 1947. Long active in ASCE, he has been president of the Iowa Section. He has served as chairman of five national committees of ASCE, the American Concrete Institute, and the American Society for Engineering Education, and as a member of seven other national committees of these and other professional societies. At the request of Governor G. Mennen Williams, he has served as the Engineering Education Representative

FRANK KEREKES
Hon. M. ASCE

on the 17-member Michigan Science Advisory Board.

In his forty-years of teaching Dean Kerekes has made notable contributions to the field by raising teaching standards and by raising learning standards—by insisting on maximum student cooperation and effort. Recently he was awarded the Army's Certificate of Appreciation for Patriotic Civilian Service by Secretary of the Army Brucker for his support of military education during the past 38 years. Another of Dean Kerekes' major concerns has been instilling in students a professional attitude.

Fred C. Scobey

Fred C. Scobey, new Honorary Member of the Society and a consulting hydraulic engineer of Berkeley, Calif., has devoted much of his career to advancing research in the hydraulics of canals and pipes for the conveyance of water.

Mr. Scobey graduated from Stanford University "with distinction," and since has been awarded honorary membership in Chi Epsilon, Tau Beta Pi, and Sigma Xi. After early work on railroad location, he gravitated toward irrigation and drainage hydraulics. As state engineer of Mississippi under Governor Vardaman, he mapped and planned drainage systems for the State Farms. Returning West, he operated the water works and reservoir system of the Raton Water Co. and Raton Ice Co. in New Mexico.

In 1910, after two years as consultant to the great Imperial Valley Canal Companies, Mr. Scobey accepted a position as irrigation engineer in the U.S. Department of Agriculture. From 1914 until his retirement a few years ago he was a research engineer in various bureaus of the Department. His studies of canals and pipes have resulted in U.S. Department of Agriculture bulletins on Flow of Water in

FRED C. SCOBEY
Hon. M. ASCE

Irrigation Channels; Flow of Water in Wood Stave Pipes; Flow of Water in Concrete Pipes; Flow of Water in Riveted Steel and Analogous Pipes; Flow of Water in Flumes; and Flow of Water in Irrigation and Similar Canals.

Results of a survey of the present and potential irrigated lands in the Western States, made by Mr. Scobey in 1934, were published by the National Resources Committee in 1936. From 1936 to 1942 Mr. Scobey was associated with Harlowe Stafford, F. ASCE, in the coordination and assemblage of data that resulted in publications of the National Resources Committee on the Rio Grande Joint Investigation and the Pecos River Joint Investigation. Both of these comprehensive studies resulted in interstate compacts under which the Rio Grande and the Pecos rivers are now administered.

Mr. Scobey has served as consultant, either directly or through consulting engineers, to the War Department, to the Bureau of Reclamation, and to Tulsa, Denver, and Eastern cities, in the matter of increasing their water supply and the conveyance of that water increase from source to city.

Becoming an Associate Member of ASCE in 1913 and a full Member in 1921, Mr. Scobey has taken an active part in Society work. He was secretary and then chairman of the Irrigation Division, on the Committee of Irrigation Hydraulics throughout its ten-year life, and later on the Research Committee. In 1938, on instruction from the Board of Direction, he organized the Hydraulics Division and served as its chairman until elected a Board Director for the 1942-1945 war years. He was Vice-President for Zone IV in 1950 and 1951. A charter member of the Sacramento Section, he served on its first Board of Directors. He has also been an officer and committee chairman of the San Francisco Section.

In 1955 at the Hydraulics Division's annual conference in Berkeley, Mr. Scobey was guest of honor at a luncheon given as a token of friendship and respect for a member who has contributed so much to the profession.

ASCE Prizes to Be Awarded During Convention

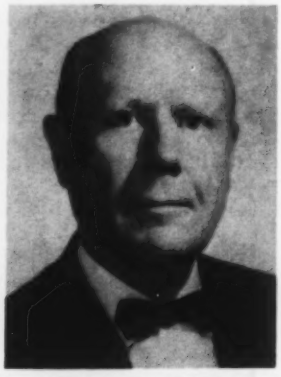
Continuing a long tradition, the Society will present prizes and awards during the Annual Convention for Transactions papers considered especially important. Though the majority of the awards honor papers appearing in Volume 124 (1959) of Transactions, several are given on the recommendation of the Technical Divisions for contributing to the advancement of the profession. Another exception is the Construction Engineering Prize, which traditionally goes to the author of an especially significant CIVIL ENGINEERING article.

The awards were announced by the Board of Direction at the Reno Convention, and they will be presented during the Wednesday morning ceremonies at the Boston Convention on October 12.

Norman Medal

This year the Normal Medal, oldest and most distinguished of the Society's awards, goes to **Carl E. Kindsvater** and **Rolland W. Carter,** Fellows ASCE, for their prize-winning paper, "Discharge Characteristics of Rectangular Thin Plate Weirs." **Professor Kindsvater** is a previous (1956) co-winner with Mr. Carter of the Norman Medal, and holder also of the James W. Rickey Medal and the Collingwood Prize. He has been on the staff of Georgia Institute of Technology since 1945, and is now Regents' Professor of Civil Engineering. As a consultant, he has directed design and research studies for numerous private and public agencies—one of them the U.S. Geological Survey, which partially supported the research reported in the prize-winning paper. **Mr. Carter,** the co-winner, has been with the U.S. Geological Survey since 1940, as hydraulic engineer, chief of the Research Section, and research engineer on the staff of the chief of the Surface Water Branch, his present position. He is author of numerous papers and reports in the field of hydraulics and hydrology.

CARL E. KINDSVATER



ROLLAND W. CARTER

Co-winners of Norman Medal

J. James R. Croes Medal

There were also two collaborators on the paper, "Thixotropic Characteristics of Compacted Clays," which was awarded the J. James R. Croes Medal, second of the Society's awards in point of distinction. They are **H. Bolton Seed,** M. ASCE, and **Clarence K. Chan,** A.M. ASCE, colleagues on the University of California engineering faculty. **Professor Seed** holds degrees from London and Harvard Universities and has been a member of their teaching staffs. Since 1950 he has been on the staff of the University of California at Berkeley, where he is now professor of civil engineering. For the past five years he has been prominently identified with the activities of the Soil Mechanics and Foundations Division, and he was

H. BOLTON SEED

CLARENCE K. CHAN

Co-winners of J. James R. Croes Medal

JACK W. HILF

Thomas Fitch Rowland Prize

ERNEST F. MASUR

James Laurie Prize

1958 winner of the Middlebrooks Award for a paper in the soil mechanics field. **Mr. Chan** has been an assistant research engineer in the university's Institute of Transportation and Traffic Engineering since 1956. He holds B.S. and M.S. degrees from the university and has spent two years in the Post Engineer's Office of the U.S. Army at Fort Huachuca.

Thomas Fitch Rowland Prize

Jack W. Hilf, F.ASCE, a soil mechanics authority, is the recipient of the Thomas Fitch Rowland Prize for his paper, entitled "Compacting Earth Dams with Heavy Tamping Rollers." Since 1946 Dr. Hilf has been employed in the Earth Dam Design Section of the Bureau of Reclamation at Denver, Colo. In his present post as supervisor of the Soil Problems Unit, he is associated with the investigation, design, and construction control aspects of many major earth dams, including the 537-ft-high Trinity Dam now nearing completion in northern California. Widely known for his technical writings, Dr. Hilf is co-author of the new Government publication, "Design of Small Dams." He is the originator of a rapid method of construction control of embankments of cohesive soils, which is being used by the Bureau of Reclamation.

James Laurie Prize

The James Laurie Prize goes to **Ernest F. Masur,** M.ASCE, professor of engineering mechanics at the Univeristy of Michigan, for his paper, "Strength of Very Slender Beams." Before going to the University of Michigan in 1955, Professor Masur spent seven years on the staff of the Illinois Institute of Technology, first as assistant professor of mechanics and then as associate professor of civil engineering. While he was at the Illinois Institute of Technology he obtained his Ph.D. in mechanics. He is the author of some eighteen publications in the field of structural analysis, with special emphasis on problems of instability and dynamics.

Arthur M. Wellington Prize

The paper on "The Vibration of Simple Span Highway Bridges," honored with the Arthur M. Wellington Prize, is the joint work of three engineers—**John M. Biggs,** M.ASCE, associate professor of structural engineering at Massachusetts Institute of Technology; **Herbert S. Suer,** A.M.ASCE, group head of the Engineering Mechanics Department of Space Technology Laboratories, Inc.; and **Jacobus M. Louw,** a partner in the consulting engineering firm of Van Wyk & Low, Cape Town, South Africa. **Professor Biggs** combines his teaching at M.I.T. with consulting work as a partner in the Cambridge (Mass.) structural firm of Hansen, Holley and Biggs. He is also a consultant on blast-resistant construction to various branches of the Armed Services. Professor Biggs was the 1955 recipient of the Moisseiff Award. Before assuming his present position, **Dr. Suer** was senior engineer for North American Aviation, Inc., and research assistant at Massachusetts Institute of Technology. He has also lectured for the past several years at the University of Southern California and the University of California at Los Angeles. After graduating from the University of Stellenbosch in South Africa in 1952, **Dr. Louw** did graduate work at Iowa State College (now university) and M.I.T., where he received his doctorate.

JOHN M. BIGGS

HERBERT S. SUER

Co-winners of Arthur M. Wellington Prize

JACOBUS M. LOUW

RALPH L. BARNETT

Collingwood Prize

JOSEPH PERAINO
Construction Engineering Prize

J. BARRY COOKE
Rickey Medal

CHARLES G. GUNNERSON
Rudolph Hering Medal

Collingwood Prize

The Collingwood Prize, which is restricted to younger members of the Society, is awarded to **Ralph L. Barnett,** A.M. ASCE, for his paper on "Prestressed Truss Beams." As research engineer for the Stanray Corporation, Chicago, Ill., Mr. Barnett is engaged in investigations of thin-shell construction and fiber reinforced plastics. A 1955 graduate of Illinois Institute of Technology, he received an M.S. in mechanics there in 1958. From 1955 until recently he was on the staff of the Armour Research Foundation, where he did pioneer work in the areas of minimum cost protective construction; minimum weight design of structures based on deflection; and prestressed segmented ceramic structures.

Construction Engineering Prize

Joseph Peraino, F. ASCE, chief engineer of the Construction Department of the Merritt-Chapman & Scott Corporation, is the winner of the Construction Engineering Prize, which is given for an important CIVIL ENGINEERING article. Mr. Peraino has been on the Merritt-Chapman & Scott engineering staff since 1940 and has been chief engineer since 1947. He has designed and worked on the installation of equipment and plant facilities for many outstanding projects, including the aggregate, batching, and cableway installations for Glen Canyon Dam, described in his prize-winning article in the June 1959 issue of CIVIL ENGINEERING.

J. C. Stevens Award

Hans A. Einstein, F. ASCE, professor of hydraulics at the University of California, Berkeley, and son of the great scientist, Albert Einstein, is the recipient of the J. C. Stevens Award for his part in the discussion of the paper, "Mechanics of Streams with Movable Beds of Fine Sand."

James W. Rickey Medal

The James W. Rickey Medal goes to **J. Barry Cooke,** F. ASCE, who is honored for a paper on "Haas Hydroelectric Power Project," and for "technical contributions and work toward progress in the technology of rockfill dams." Mr. Cooke has been with the Pacific Gas and Electric Company since his graduation from the University of California in 1939. He was awarded the Bronze Star Medal for World War II Service with the Army Corps of Engineers in bridging the Rhine and saving the Remagen Bridge. Since the war he has been associated with P. G. and E.'s nuclear power program and with fifteen of its hydroelectric developments.

Rudolph Hering Medal

Charles G. Gunnerson, F. ASCE, winner of the Rudolph Hering Medal for his paper on "Sewage Disposal in Santa Monica Bay," recently became senior water pollution control engineer in the California Department of Water Resources at Sacramento. Except for time out for military service in the Signal Corps in World War II and in the Corps of Engineers in the Korean War, Mr. Gunnerson was a civil engineer in the City of Los Angeles Bureau of Sanitation from 1940 to 1960. From 1953 until recently he was in the Bureau's Research and Planning Section engaged on a number of projects on the collection and disposal of both liquid and solid municipal waste. He conducted the sanitary engineering and oceanographic investigations of Santa Monica Bay, made by four agencies, that formed the basis of his prize-winning paper.

F. E. RICHART, JR.
Thomas A. Middlebrooks Award

FRANK BARON

HAROLD S. DAVIS
Co-winners of Leon S. Moisseiff Award

Thomas A. Middlebrooks Award

F. E. Richart, Jr., F. ASCE, professor of civil engineering at the University of Florida, is the winner for the second consecutive year of the Thomas A. Middlebrooks Award. This year's prize-winning paper is entitled "Review of the Theories for Sand Drains." He has been on the University of Florida staff since 1952, and has been a full professor since 1954. Professor Richart has just returned to the university after a year's leave of absence on a Science Faculty Fellowship of the National Science Foundation. He devoted part of the year to special studies in soil mechanics at Harvard, and part to the study of harbor structures at the Delft Technological University.

OTHMAR H. AMMANN
Ernest E. Howard Award

WILLIAM PRAGER
Theodore von Karman Award

Leon S. Moisseiff Award

There are two collaborators on the paper, entitled "Pressure Lines and Inelastic Buckling of Columns," which receives the Leon S. Moisseiff Award. They are **Frank Baron,** F. ASCE, professor of civil engineering at the University of California, Berkeley, and **Harold S. Davis,** M. ASCE, structural engineer for the General Electric Company at Richland, Wash. **Professor Baron** served as an assistant and associate professor at Yale University from 1939 to 1946 and as professor of civil engineering at Northwestern University from 1946 to 1953. He joined the University of California faculty in 1953. He has served as consultant to various organizations on analytical and experimental topics in structural engineering, and has to his credit some thirty technical publications. **Mr. Davis** met his collaborator at Northwestern University, where he worked under Professor Baron's direction for his Ph.D. on the elastic and inelastic behavior of columns. He taught at Washington State University for two years before joining the General Electric Company's Hanford Atomic Products Operation. He is currently responsible for the structural design of reactor buildings and associated shielding structures.

Ernest E. Howard Award

Othmar H. Ammann, Hon. M. ASCE, consulting engineer and partner in the New York firm of Ammann & Whitney, is the recipient of the Ernest E. Howard Award. Promient for over half a century as planner and designer of great bridges and other important structures, Mr. Ammann is currently honored "for design and construction of outstanding bridges of record dimensions, and large engineering works, including the George Washington Bridge, the Lincoln Tunnel under the Hudson River, and the Narrows Bridge now under construction at the entrance to New York Harbor."

Theodore von Kármán Award

William Prager, F. ASCE, specialist in engineering mechanics and L. Herbert Ballou University Professor at Brown University, is honored with the Theodore von Kármán Award "in recognition of distinguished achievement in engineering mechanics." Born and educated in Germany, Dr. Prager was acting director of the Applied Mechanics Institute at the University of Gottingen from 1929 to 1933, and professor of theoretical mechanics at the University of Istanbul from 1933 to 1941. Since the latter year he has been on the Brown University faculty, for most of the period as professor of applied mechanics. He has six books and over 140 scientific and technical publications to his credit.

Tellers Canvass Ballot for 1961 Officers

New York, N. Y.
September 15, 1960

To The 1960 Annual Meeting
American Society of Civil Engineers:

The Tellers appointed to count the Election Ballot for Officers of the Society report as follows:

For President
(Term October 1960-October 1961)

Glenn Willis Holcomb	**13,757**
Scattering	**17**
Void	**9**

For Vice President—Zone II
(Term October 1960-October 1962)

Donald H. Mattern	**2,629**
Scattering	**26**
Void	**201**

For Vice President—Zone III
(Term October 1960-October 1962)

William J. Hedley	**2,504**
Don M. Corbett	**1,730**
Scattering	**6**
Void	**19**

For Director—District 1
(Term October 1960-October 1963)

Rober H. Gilman	**927**
Arthur T. Larned	**580**
Scattering	**8**
Void	**29**

For Director—District 2
(Term October 1960-October 1963)

Henry W. Buck	**637**
Scattering	**4**
Void	**26**

For Director—District 6
(Term October 1960-October 1963)

Earle T. Andrews	**711**
Scattering	**5**
Void	**77**

For Director—District 9
(Term October 1960-October 1963)

John B. Scalzi	**979**
Scattering	**12**
Void	**21**

For Director—District 10
(Term October 1960-October 1963)

John D. Watson	**1,036**
Scattering	**5**
Void	**61**

For Director—District 11
(Term October 1960-October 1963)

Harmer E. Davis	**2,188**
Scattering	**18**
Void	**195**
Ballots counted	**28,447**
Ballots envelopes rejected without signature	**54**
Dues arrears	**102**

Respectfully submitted,
JOSEPH N. RIZZI,
Chairman

RICHARD D. EGAZARIAN,
Vice Chairman

Neal H. Bettigole
Anthony J. Castro
David B. Hill
Victor A. Hošang
Leon Goodman
Norman Karger
Tellers

Congratulations for UEC Fund-Raising Personnel

To All Local Section Officers
and Fund-Raising Personnel
Gentlemen:

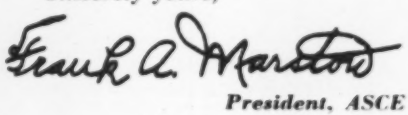
I have been eagerly awaiting—ever since my induction as President of ASCE last October—this opportunity to congratulate and to thank all of those who have borne the burden of the United Engineering Center campaign. The achievement in August of the $800,000 quota of the Society should bring to every one of you a deep sense of pride in worth-while accomplishment.

The successful completion of this drive means much more to ASCE than just the fulfillment of an intersociety responsibility. Your efforts here have enhanced the stature and prestige of our great Society. You have helped to make ASCE an inspiration to its associates in the UEC venture, thus affirming the leadership in the engineering profession that ASCE has enjoyed through the years.

Our arduous campaign carried through almost three years, and I speak for Past-Presidents Francis S. Friel and Louis R. Howson as well as myself in acknowledging the magnitude and importance of your service. Indeed, Mr. Friel himself is due a special word of recognition for the leadership and personal effort that he devoted to the campaign in 1958-1959, when 62% of the total quota was pledged. It was in that year that the ultimate success of our campaign became assured.

I only wish that it were possible for me to commend and to thank each one of you in person. Proud as I shall be of your new Engineering Center, I am even more proud of my fellow Society members who have helped to make the Center a reality.

Sincerely yours,



President, ASCE

The Society's UEC Campaign Statistics as of August 31, 1960

Local Section	Quota	Contributions Number	Contributions Amount†	Contributions % Quota	% Assigned Members Contributing
ZONE I	$197,300	2,508	$221,257	112	23
District 1	133,300	1,809	151,200	113	18
Brazil	2,100	8	343	16	7
Metropolitan	119,200	1,135	142,582	120	27*
Panama	1,300	39	1,078	83	56*
Puerto Rico	3,100	57	3,563	115	33*
Rep. of Colombia	2,400	9	474	20	8
Venezuelan	5,200	61	3,160	61	23
District 2	43,400	809	44,904	103	35
Connecticut	11,000	183	12,121	110	34
Maine	4,700	101	4,862	103	35
Massachusetts	23,000	419	23,569	102	34
New Hampshire	1,800	45	1,296	72	37*
Rhode Island	2,900	58	2,981	103	40
District 3	20,600	390	22,653	110	29
Buffalo	4,400	98	4,505	102	36*
Ithaca	2,400	52	3,488	145	39*
Mohawk-Hudson	7,500	92	6,051	81	23*
Rochester	1,900	42	2,373	125	44
Syracuse	4,400	84	4,841	110	43*
ZONE II	169,700	3,523	167,656	99	37
District 4	34,000	713	47,136	139	38
Delaware	4,100	128	4,553	111	61
Lehigh Valley	4,200	104	5,733	137	45
Philadelphia	20,000	298	30,623	153	25*
Central Pa.	5,700	183	6,227	109	48
District 5	27,000	672	21,343	79	43
National Capital	27,000	672	21,343	79	43*
District 6	49,000	930	51,458	105	37
Maryland	15,000	363	16,400	109	48*
Pittsburgh	17,000	298	16,439	97	35
Virginia	13,300	224	13,369	101	32
West Virginia	3,700	45	5,250	142	21
District 10	59,700	1,208	45,219	76	35
Alabama	8,900	157	5,205	58	29
Florida	11,500	77	4,324	38	10*
Georgia	10,400	226	11,438	110	39
Miami	5,200	56	3,454	66	19
Nashville	2,700	57	2,778	103	35
North Carolina	6,300	76	4,535	72	19
South Carolina	5,500	120	3,346	61	42
Tennessee Valley	9,200	439	10,139	110	92*
ZONE III	202,200	4,005	187,803	93	35
District 7	39,900	761	27,742	70	33
Duluth	1,500	47	1,538	103	82*
Michigan	18,000	252	9,314	52	27
Northwestern	8,000	120	4,464	56	25
Wisconsin	10,700	308	11,389	106	47
South Dakota	1,700	34	907	53	27
District 8	37,100	624	39,230	106	29
Central Illinois	6,500	151	7,098	109	35*
Illinois	$29,000	395	$20,341	105	25
Tri-City	1,600	78	1,801	118	79
District 9	45,700	1,015	51,192	112	40
Akron	3,100	61	2,121	68	35
Central Ohio	5,100	172	5,517	108	60
Cincinnati	4,700	129	6,735	143	49
Cleveland	9,300	119	9,379	101	25*
Dayton	3,300	39	2,314	70	21
Indiana	11,000	317	15,476	141	49
Kentucky	6,100	128	7,531	123	33
Toledo	3,100	50	2,119	68	34
District 14	31,500	560	24,815	79	31
Mid-Missouri	3,500	111	2,828	81	46
Mid-South	11,000	147	7,424	67	24
Oklahoma	6,900	123	5,707	83	31
St. Louis	10,100	179	8,856	88	32
District 16	48,000	1,045	42,224	88	39
Colorado	13,900	117	6,209	44	15
Iowa	5,900	148	6,257	106	42
Kansas City	12,000	353	14,258	119	53
Kansas	7,600	220	6,436	85	57
Nebraska	6,300	152	6,725	107	40
Wyoming	2,300	55	2,339	102	52
ZONE IV	230,800	4,694	232,263	101	35
District 11	132,600	2,826	133,397	101	36
Arizona	5,000	156	5,560	111	45
Hawaii	6,300	249	8,163	130	60
Intermountain	4,700	89	4,112	87	30
Los Angeles	50,200	912	52,844	105	33*
Sacramento	16,300	499	14,218	87	47
San Diego	6,000	109	3,768	63	30
San Francisco	44,100	812	44,732	101	32*
District 12	40,400	960	40,202	99	41
Alaska	2,200	32	2,389	109	23*
Columbia	2,200	82	3,011	137	56*
Montana	3,300	97	3,339	101	39
Oregon	10,900	177	6,879	63	32
Seattle	12,200	289	12,200	100	40*
Southern Idaho	2,300	78	4,625	201	62
Spokane	3,100	83	3,141	101	44
Tacoma	4,200	114	4,233	101	52*
District 15	57,800	908	55,964	97	28
Louisiana	13,000	116	13,173	101	16*
Mexico	1,400	15	763	55	17
New Mexico	4,000	46	2,244	56	19
Texas	39,400	730	39,784	101	34*
Total	$800,000	14,729	$808,779	101	33

* Denotes Local Sections making contributions from Section funds.

† Total of Local Section contributions do not reconcile with District and Zone totals because (*a*) some pledges were requested to be distributed directly to Zones, and (*b*) pledges of Canadian members are assigned directly to certain Districts.

Ninth Hydraulics Conference Held in Seattle

Well over 200 engineers took part in the Hydraulics Division's Ninth Annual Conference, held at the University of Washington, August 17-19. The co-hosts—the Seattle Section and the University of Washington—provided exceedingly comfortable surroundings and generous entertainment for the occasion. In welcoming the conference, Dean Harold E. Wessman urged the group to give serious professional attention to its "continuing responsibilities in the development and conservation of water resources."

Prof. Eugene P. Richey, the conference chairman, had prepared the facilities of his splendid Hydraulics Laboratory for inspection, and had also made arrangements for the group to visit the Departments of Oceanography and Fisheries, where related activities are in progress.

The conference program was aimed at the refinement of engineering techniques. There were six sessions, each sponsored by one of the Division's technical committees—Hydromechanics, Tidal Hydraulics, Hydraulic Structures, Hydrology, Flood Control, and Sedimentation. Of special interest to delegates from the Pacific Northwest were papers dealing with fish-passage problems of hydraulic structures. The papers presented will be made available for study through the publications of the Society. For reference, the full program was printed in the July issue.

The social program, organized by the co-hosts, was highlighted by a boat trip across Puget Sound to a salmon barbecue, and by the traditional conference banquet. The featured conference speaker was Dr. Paul J. Raver, superintendent of Seattle City Light.

Seen in usual order are Prof. Wallace M. Lansford, of the University of Illinois, representing the hosts for the Tenth Hydraulics Conference to be held at Urbana in 1961; Prof. Eugene P. Richey, general chairman of the Hydraulics Division Conference Committee, representing the hosts for this year's conference; Maurice L. Dickinson, of the Bechtel Corporation, San Francisco, vice chairman of the Executive Committee of the Hydraulics Division; and Dr. Arthur T. Ippen, of the Massachusetts Institute of Technology, chairman of the Division's Executive Committee.

An all-day pre-conference trip to the Skagit River Project of Seattle City Light was enjoyed by a large group.

During a meeting of the Division Executive Committee, held during the conference, Prof. Arno T. Lenz was elected Division secretary, to replace Harold M. Martin, who has served in this capacity for several years during the expansion of Division activities. Maurice L. Dickinson was elected chairman, with the responsibility of guiding the Division through its 1960-1961 activities. Mr. Dickinson succeeds Arthur T. Ippen in this capacity.

Next year's Hydraulics Conference, the tenth, will be held at Urbana, Ill., August 16-18.

NCSBEE Adopts Revised Model Law

Adoption of a revised Model Law on engineering registration and a "Chapter II" covering the registration of land surveyors highlighted the annual meeting of the National Council of State Boards of Engineering Examiners in Portland, Ore., August 18-20.

Some provisions of the Model Law are in conflict with Society policy. In an attempt to eliminate controversial features of the proposed "Corporate Practice and Partnership Obligations" wording, the Society joined with the Consulting Engineers Council and the American Institute of Consulting Engineers to draft substitute sections that would gain general acceptance by participating organizations.

The redraft was made available to the NCSBEE Committee several weeks prior to the Portland meeting. However, no changes were made in the provisions for corporate practice in the final report on the revised Model Law submitted to NCSBEE in Portland and subsequently adopted.

ASCE had also recommended changes that would recognize the professional nature of the four major categories of surveying, in keeping with Society policy. A separate chapter in the new Model Law provides for the registration of land surveyors. This treatment is at variance with the ASCE Board of Direction declaration, "That state engineer examination boards should give appropriate recognition to professional-level experience in surveying and mapping." Society efforts to include specific mention of geodetic, cartographic and engineering surveys in the engineering law, proved unproductive.

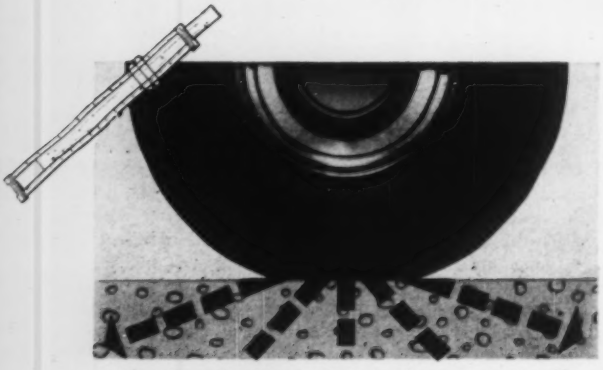
The engineering societies will be asked to endorse the Model Law. It will be examined by the ASCE Committee on Registration of Engineers and recommendations made to the Board of Direction.

NCSBEE committees recommended that provisions be added to the Model Law for closer control of corporations and others working with public bodies and that all candidates for registration be required to take the written examination.

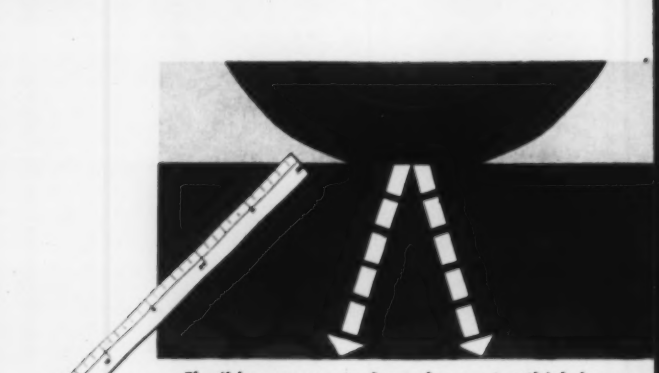
Arnold L. Henry, F. ASCE, with the Corps of Engineers at Portland, Ore. was elected president. The 1962 annual meeting will be held in Kansas City.

Interstate 95...precision engineered to fit future traffic!

gives design strength figured



The strength of concrete is in the concrete itself. Compressive and flexural strengths can be computed and measured exactly. Designs are based on *facts*—not intuition.



Flexible pavements depend on extra-thick layers to minimize concentrating load forces on subgrade. And materials of non-uniform strength and quality prevent exact load-bearing designs.

CONCRETE

with a "slipstick"—not a yardstick!

Use of concrete on Connecticut's Interstate 95 permitted load strength to be based on a mathematical formula rather than empirical deep-bulking of material.

Today's exact knowledge of the nature of concrete, enables engineers to design pavements *precisely*—with no over-building "just to be sure." Thus, maximum strength is obtained with minimum thickness—along with important saving of materials.

The reason is well-known: Concrete is rigid, not flexible—so there are no "moving parts" to cause structural changes. The beam strength only concrete can provide supports and spreads vehicle loads, keeps pressures on the subgrade permanently within safe limits.

This is why engineers can design highway pavements of concrete to last 50 years and more—with upkeep costs running as much as 60% lower than for asphalt. This is why you are seeing concrete chosen for vital heavy-duty routes—particularly on the new Interstate System.

PORTLAND CEMENT ASSOCIATION *A national organization to improve and extend the uses of concrete*

Pittsburgh Section Host to Electronic Computation Conference

Another significant program in the field of electronic computation and its application to the civil engineering field was presented in Pittsburgh, Pa., September 7-9. Held at the Hilton Hotel, in the heart of Pittsburgh's famed Golden Triangle, the Second National Conference on Electronic Computation was attended by 400 engineers—from 35 states and from a number of foreign countries, including Canada, Sweden, and Australia.

A total of 32 technical papers on many phases of electronic computation were presented at the two-day session sponsored by the Committee on Electronic Computation of the Structural Division and by the Pittsburgh Section. Of prime importance to the advancement of any new tool, process, or procedure is the dissemination of pertinent information to those who will benefit most from it. Whether it be the comparison of methods of programming, or a critical analysis of various types of computer equipment, or the exchange of completed programs, the sharing of this information has been and will continue to be a vital link in the success of electronic computers in the field of civil engineering. Through the Conferences on Electronic Computation engineers have been able to get together with other interested engineers and with manufacturers' representatives and users to discuss mutual problems in the computer field.

In the keynote address, George S. Richardson, senior partner in the Pittsburgh firm of Richardson, Gordon and Associates, stated that the impact of electronic computation on civil engineers was clearly indicated by the large attendance. He commended the group for its desire to contribute their knowledge to the profession. Such engineers, he said, demonstrate a true professional attitude. More than 30 of those attending the meeting delivered formal papers, and many others participated in the discussions that followed nearly all the presentations.

Computer demonstration

An important feature of the conference was a computer demonstration which included equipment in the field from various manufacturers, some of it on public display for the first time. Among the companies participating were Friden, I.B.M., National Cash Register, and Bendix. Informative seminars, by representatives of some of these companies, were presented in the evenings and provided an ideal opportunity for engineers to ask questions about computers—both the "hardware" and its operation.

Papers available

The distribution of this information will go far beyond the engineers attending the meeting. All the papers presented at the conference will be published in a single hard-board volume, priced at $13, with a 50 percent discount to ASCE members. A listing of the conference papers and authors appeared in the program in the August issue. The anticipated mailing date for this limited edition is December 15, and a coupon for ordering will appear in the December issue.

Attesting to public interest in electronic computers was the presence of high-ranking state and city officials at the Second National Conference on Electronic Computation. Shown, in usual order, are Michael A. Gross, president of host (Pittsburgh) Section; David L. Lawrence, governor of Pennsylvania; Neal Dean of Chicago, who addressed a luncheon meeting on "A Vision of Our Automatic Future"; Joseph M. Barr, mayor of Pittsburgh; and Charles B. Molineaux, Vice President of ASCE for Zone I.

Aid Asked in Reviewing ASCE Manual of Practice

As announced in the September issue, the Board of Direction is seeking the critical comment of the Society's membership on a proposed Manual of Engineering Practice, prepared by the Committee on Structural Dynamics of the Engineering Mechanics Division for possible publication. The Manual was written for the use of the engineering profession in the design of structures which are intended to be resistant in some degree to all the effects associated with the detonation of a nuclear weapon.

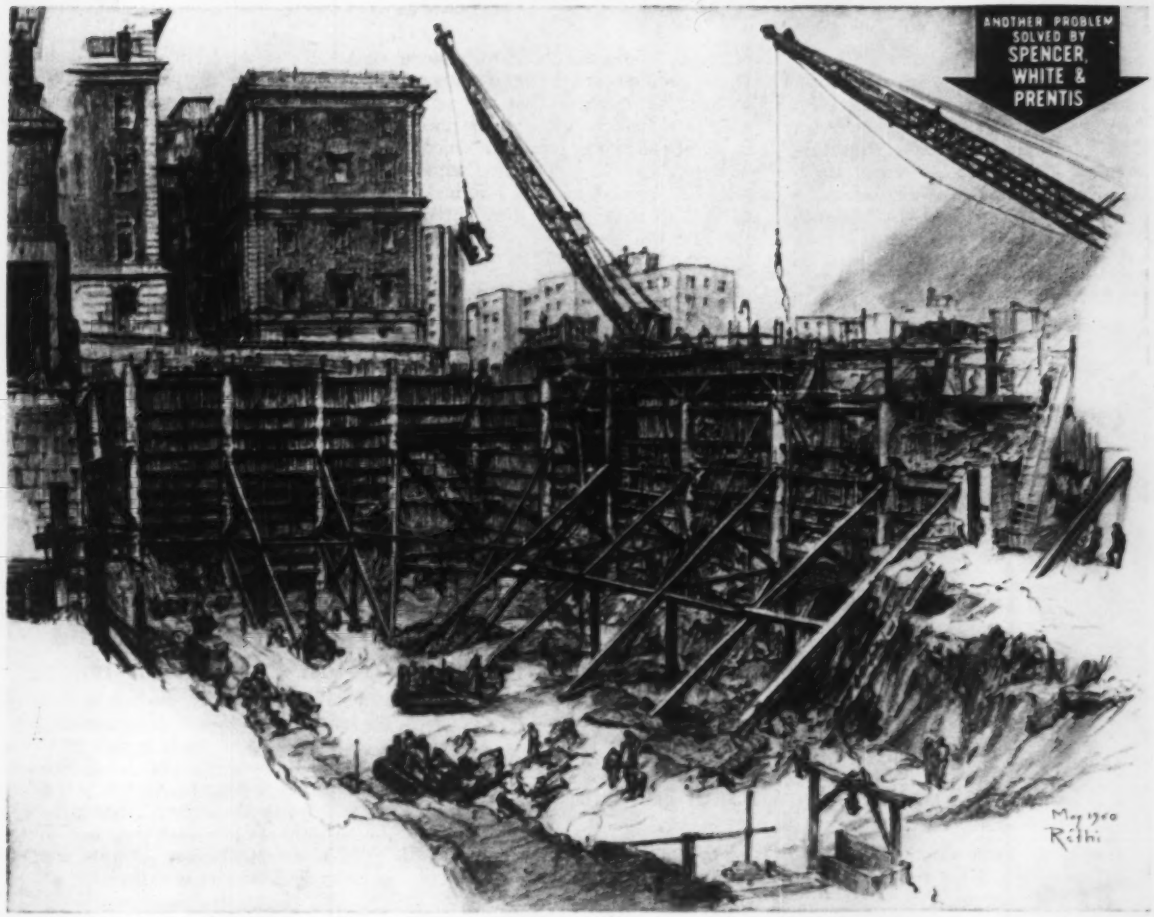
Before the Manual is released for publication, the Board of Direction will appreciate having the critical review of interested members. The comments will be used in preparation of the final manuscript.

Members wishing to review the Manual may obtain copies on a loan basis from the Executive Secretary. Copies may be kept for two weeks. Comments are due at Society headquarters before November 15.

Civil Defense Data To Be Made Available

Latest data prepared by the Office of Civil and Defense Mobilization, pertaining to civil engineering, are being made available to the entire membership, through the ASCE Coordinating Committee on Civil Defense in cooperation with the OCDM. This information of current and continuing importance is being mailed directly to each member by the U. S. Government, with ASCE contributing the mailing list.

Distribution of this information is one of the functions of the ASCE Coordinating Committee. In its studies



Project: 100' x 260' foundation for addition to New York City's Mt. Sinai Hospital
Architect: Eggers & Higgins, New York City
Engineer: Weiskopf & Pickworth, New York City
General Contractor: Peaty & Fuhrman, Inc., New York City

NEW METHOD OF BANK SUPPORT: DRILLED-IN CAISSONS USED AS MASTER PILES IN SHEETING 50' DEEP CUT THROUGH ROCK FILL

In digging this foundation, the shovel unexpectedly struck large pieces of blasted rock, probably dumped as fill during subway excavating many years ago. Since the soldier beams of the originally-planned conventional system of sheeting and bracing could not be driven through these massive boulders, it became necessary to devise some other method of supporting the 50' deep cut.

Solution: in what is believed to be their first use for such a purpose, Drilled-In Caissons, long a specialty of Spencer, White & Prentis, were successfuly employed as Master Piles. The 30" diameter caissons, about 20' on centers, were drilled and driven through the boulder fill. 10" - 42# cores were then installed, concreted and socketed 4' into bedrock. Descriptive literature on request.

Spencer, White & Prentis inc.
10 E. 40th St., New York 16, N. Y.
Detroit: 2033 Park Ave. • Chicago: 221 North LaSalle St. • Washington, D. C.: Tower Bldg.

with the OCDM, the committee became aware of many responsibilities of civil engineers which did not seem to be getting enough attention. As a first step toward correcting the situation, it determined to cooperate in disseminating all available information.

Another objective of the Coordinating Committee is to encourage the attention and constructive cooperation of Local Sections and Student Chapters. Local Sections are being encouraged to carry on activities that will assure the participation of civil engineers in local planning for civil defense. The work of the Student Chapters will be largely of an informative nature, so that young men entering the field will recognize the civil engineering aspects of defense planning.

SOCIETY AWARDS AND FELLOWSHIPS AVAILABLE

DANIEL W. MEAD PRIZES:	*1961 contest closes May 1, 1961. See 1960 Official Register, page 149. Topic for 1961 contest announced in July issue (page 43).*
FREEMAN FELLOWSHIP:	*1961 contest closes March 1, 1961. See Official Register, page 156.*
J. WALDO SMITH HYDRAULIC FELLOWSHIP:	*1961-62 contest closes April 1, 1961. See Official Register, page 156.*
RESEARCH FELLOWSHIP:	*1961 contest closes Jan. 1, 1961. See Official Register, page 156.*
ERNEST E. HOWARD AWARD:	*Closing date Feb. 1, 1961. See Official Register, page 148.*

EUSEC to Publish International Education Report

One of the most successful EUSEC meetings ever held has come to a close in Brussels, Belgium. The Société Royale Belge des Ingénieurs et des Industriels was host to this seventh plenary assembly of the Conference of Engineering Societies of Western Europe and the United States, which took place August 29-September 3. Perhaps the most important action taken at the conference was authorization to publish the cooperative international report on engineering education, which has been under study for the past eight years.

The report, to be published in French and English, covers practices on the education and training of engineers in the nineteen countries participating in the conference. It will also include data on the number of students represented in each of the branches of engineering. The report will be available in March 1961. Distribution in the United States will probably be through the Engineers Council for Professional Development and the five U.S. societies participating in EUSEC. The engineering education study has been sponsored by the EUSEC Committee on Engineering Education and financed by a $60,000 grant from the Ford Foundation and the Office of European Economic Cooperation. Thorndike Saville, F. ASCE, is chairman of the committee.

Another important action of the assembly was the decision to study ethical standards on an international basis. To implement this decision, machinery was set up for assembling information on Codes of Ethics in the EUSEC societies. The project will have the ultimate hope of developing an international code.

There was also a long discussion of research in the engineering societies, with the aim of a mutual exchange of information about developments in this vital area. Another important subject that came up for study was the splinter groups, or fragmentation, resulting from the development of new engineering specialties.

The U.S. delegation at the conference included W. L. Cisler, president of ASME; E. H. Linder, president of AIEE; E. Piret, representative of AIChE; O. B. Schier, secretary of ASME; and Thorndike Saville, chairman of the EUSEC Committee on Engineering Education. ASCE was represented by President Frank A. Marston and Executive Secretary William H. Wisely. Mr. Wisely also represented the AIME.

On several occasions during the meeting acknowledgment was made of ASCE's stewardship as the secretariat of EUSEC for the past two years and for its trusteeship for the financing of the engineering education study. At the close of the meeting the secretariat passed to the Société Royale Belge des Ingénieurs et des Industriels. However, Mr. Wisely will continue as secretary of the EUSEC Committee on Engineering Education until its report has been published.

Messrs. Marston and Wisely were designated by EUSEC to represent it at the forthcoming meeting of the Pan American Federation of Engineering Societies (UPADI) and to report to it on EUSEC activities. The UPADI meeting is being held in Buenos Aires, September 18-22.

The next EUSEC meeting will be held in 1962 in Munich, with the Verein Deutscher Ingenieure as host.

Kansas City Section to Host Power Conference

The Kansas City Section is sponsoring another of the fall technical conferences for which it is fast becoming famous among Midwest Local Sections. This year's program—a Power Conference, with the Power Division as co-host—is set for the Continental Hotel in Kansas City, November 10 and 11. Ray E. Lawrence is chairman.

The keynote address launching the program, on Thursday morning, is entitled, "The Power Industry: Where Is It Going?". It will be presented by Walker L. Cisler, president of the Detroit Edison Company, and president of the American Society of Mechanical Engineers. Another program highlight will be the Friday luncheon meeting, at which Brig. Gen. A. W. Betts will speak on "Making Power with Rockets." General Betts is director of the Advanced Research Projects Agency, Office of the Secretary of Defense. At the Thursday luncheon R. A. Olson, president of the Kansas City Power & Light Company, will be featured speaker.

The ambitious technical program is planned to appeal to a wide range of interests in the power field. Among the topics are: selecting the plant site; indoor or outdoor plant; the future of hydroelectric development; financing power projects; latest trends in steam plants; and the role of the civil engineer in atomic power generation. A tour of recent power plant improvements in the Kansas City area will supplement the program.

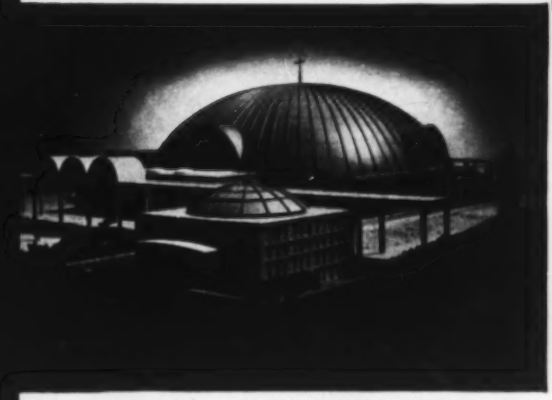
A cocktail party late Thursday afternoon will be the social highlight. The Kansas City Section will be host.

Raised in 5½ Working Days

WITH BETHLEHEM HIGH-STRENGTH BOLTS

The steel framework for the Greek Orthodox Church in Oakland, California, was erected in just 5½ working days. Bethlehem high-strength bolts were used to connect the 115 tons of structural steel for the church and an adjacent classroom building. Besides speeding the work, bolting eliminated the clatter of riveting guns in this residential area.

Architects and engineers: Reid, Rockwell, Banwell & Tarics
General contractors: Williams & Burrows, Inc.
Fabrication and erection: Bethlehem Steel Co.



Due to be completed in September, 1960, the church will serve the city of Oakland and vicinity.

High-strength bolts are installed quickly, easily, and more safely.

- Joints cannot work loose. They're permanently tight.
- No fire hazard. Bolts are installed cold.

Manufactured to ASTM Specification A-325, Bethlehem high-strength bolts are supplied in a full range of sizes for every construction need. Made of carbon steel, they are heat-treated by quenching and tempering.

High-strength bolts will save you time and money next time there's steel to be erected. And make sure that they are Bethlehem high-strength bolts. For full information write us today, or call your nearest Bethlehem sales office.

Steel for strength . . . economy . . . versatility

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Sales: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

Column Research Council Issues Metal Design Guide

Guide to Design Criteria for Metal Compression Members, a recent publication of the Column Research Council, is a "must" for structural engineering offices. The 112-page book presents a condensed summary of design criteria based upon recent as well as past research on metal compression members in buildings and bridges. The book is written expressly for the engineer who either has to solve special problems not covered by standard specifications or is himself engaged in the preparation of specifications for such structures. It is applicable to aluminum, steel, and other metals.

The price of the 8½ x 11-in. volume bound in leatherette is $5.00 a copy. Orders may be placed with the Secretary, Column Research Council, 313 West Engineering, University of Michigan, Ann Arbor, Mich.

Organized sixteen years ago under ASCE sponsorship, the Column Research Council has conducted an energetic and fruitful program of research on structural columns, with the ultimate aim of cheaper and better structures. The Council is an Engineering Foundation project.

ASCE ENGINEERING SALARY INDEX

(Prepared Semiannually)

Consulting Firms

City	Current	Previous
Atlanta	1.21	1.38
Baltimore	1.14	1.14
Boston	1.23	1.22
Chicago	1.49	1.45
Denver	1.25	1.24
Houston	1.26	1.26
Kansas City	1.15	1.13
Los Angeles	1.32	1.28
Miami	1.38	1.57
New Orleans	1.22	1.18
New York	1.29	1.25
Pittsburgh	1.07	1.07
Portland (Ore.)	1.24	1.27
San Francisco	1.34	1.30
Seattle	1.06	1.06

Highway Departments

Region	Current	Previous
I, New England	1.03	1.01
II, Mid Atlantic	1.15	1.14
III, Mid West	1.29	1.27
IV, South	1.12	1.12
V, West	1.16	1.06
VI, Far West	1.17	1.17

Sole purpose of this Index is to show salary trends. It is not a recommended salary scale. Nor is it intended as a precise measure of salary changes. The Index is computed by dividing the current total of base entrance salaries for ASCE Grades I, II, and III by an arbitrary base. The base used is $15,930, the total of salaries paid in 1956 for Federal Grades GS5, GS7 and GS9. Index figures are adjusted semiannually and published monthly in CIVIL ENGINEERING. Latest survey was July 30, 1960.

Holland Host to Conference on Coastal Engineering

Some 50 papers were presented at the Seventh International Conference on Coastal Engineering, held in The Hague, Holland, August 22-27. The attendance of 150 represented 24 countries. Most of the 30 delegates from the U.S. are members of ASCE. The conference was sponsored by the Council on Wave Research of Engineering Foundation. Seen at the opening session are, left to right, Prof. Joe W. Johnson, F. ASCE, University of California, secretary of the Wave Council; Dean Emeritus Morrough P. O'Brien, F. ASCE, University of California, chairman of the Wave Council and president of the conference; A. G. Maris, director-general of Rijkswaterstaat of the Netherlands, who presided at the opening session; Dean Emeritus Thorndike Saville, F. ASCE, New York University, now consultant to the president of the University of Florida, member of the Wave Council, and president of the two preceding conferences; and J. B. Schiff, chief engineer, Rijkswaterstaat. The Council on Wave Research was initiated by ASCE.

ASCE CONVENTIONS

PHOENIX CONVENTION
Phoenix, Ariz.
Hotel Westward Ho
April 10-14, 1961

ANNUAL CONVENTION
New York, N. Y.
Hotel Statler
October 16-20, 1961

HOUSTON CONVENTION
Houston, Tex.
Hotel Shamrock
February 19-23, 1962

DISTRICT CONFERENCES

DISTRICT 3 COUNCIL
Syracuse, N. Y.
Airways Inn
November 19, 1960

LOCAL SECTION MEETINGS

Illinois—Dinner-meeting of the Soil Mechanics and Foundations Division at Toffenetti's Restaurant, Chicago, November 9, at 5:30 p.m.

Kansas City—Annual Power Conference at the Continental Hotel, Kansas City, Mo., November 10 and 11.

Metropolitan—Regular monthly meetings in the Engineering Societies Building on the third Wednesday of each month, at 7:00 p.m.

Los Angeles—Annual ladies night dinner-dance in the Venetian Room of the Ambassador Hotel, Los Angeles, October 22, at 7:00 p.m.; dinner-meeting of the Riverside-San Bernardino Branch at the California Electric Power Company, San Bernardino, October 18, at 6:00 p.m.; dinner-meeting of the Pipeline Group at the Engineers Club in the Biltmore Hotel, Los Angeles, October 26, at 6:30 p.m.; dinner-meeting of the Sanitary Engineering Group at the Engineers' Club in the Biltmore Hotel, Los Angeles, October 26, at 6:30 p.m.; and dinner-meeting of the Structural Group at the Rodger Young Auditorium, Los Angeles, October 19, at 6:30 p.m.

Philadelphia—Regular monthly meeting at the Engineers' Club on November 8.

Sacramento—Weekly meetings at the Elks Temple every Tuesday, at 12 noon.

Tennessee Valley—Fall meeting at the Hotel Patten, Chattanooga, November 4 and 5.

Hot-mix Texaco Asphaltic Concrete pavement is speedily laid on 11 miles of Nebraska State Highway 61.
No time-consuming curing period is required.

Nebraska builds Asphalt highway for hauling wheat crop

This 11-mile section of State Highway 61 passes through Nebraska's fertile wheat growing country. At harvest time, heavy trucks loaded with grain use the highway to reach elevators and rail heads.

The pavement constructed on this heavily traveled route consists of three inches of heavy-duty hot-mix Texaco Asphaltic Concrete, laid on a six inch granular base. The Texaco Asphaltic Concrete was placed in two courses, a 1½ inch binder course and 1½ inch wearing surface. Nebraska used an asphalt cement with a 100–120 penetration in the pavement mix.

This Texaco-paved State Highway combines rugged durability with a moderate first cost and low upkeep cost. It is speedily laid, since it requires no time-consuming curing period. Because of its resilience and freedom from expansion joints, it has a velvet-smooth riding surface which is appreciated by truck drivers and motorists alike.

Texaco Asphalt Cements, Cutback Asphalts and Slow-curing Asphaltic Oils provide the road builder with a wide choice of heavy-duty, intermediate and low-cost types of paving for highways, streets and airports. Whatever your paving project, one of these types is exactly suited to your requirements. For helpful information on all of these Asphalt types, mail the coupon below for the two Texaco brochures. There is no obligation.

Contractor: NORTHWESTERN ENGINEERING COMPANY

TEXACO INC., Asphalt Sales Div., 135 E. 42nd Street, New York 17

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Minneapolis 3 • Philadelphia 2 • Richmond 25

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TEXACO ASPHALT

Please send me your two brochures containing helpful information on heavy-duty, intermediate and low-cost types of asphalt construction for highways, streets, airports, etc.

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Name..... Position.....

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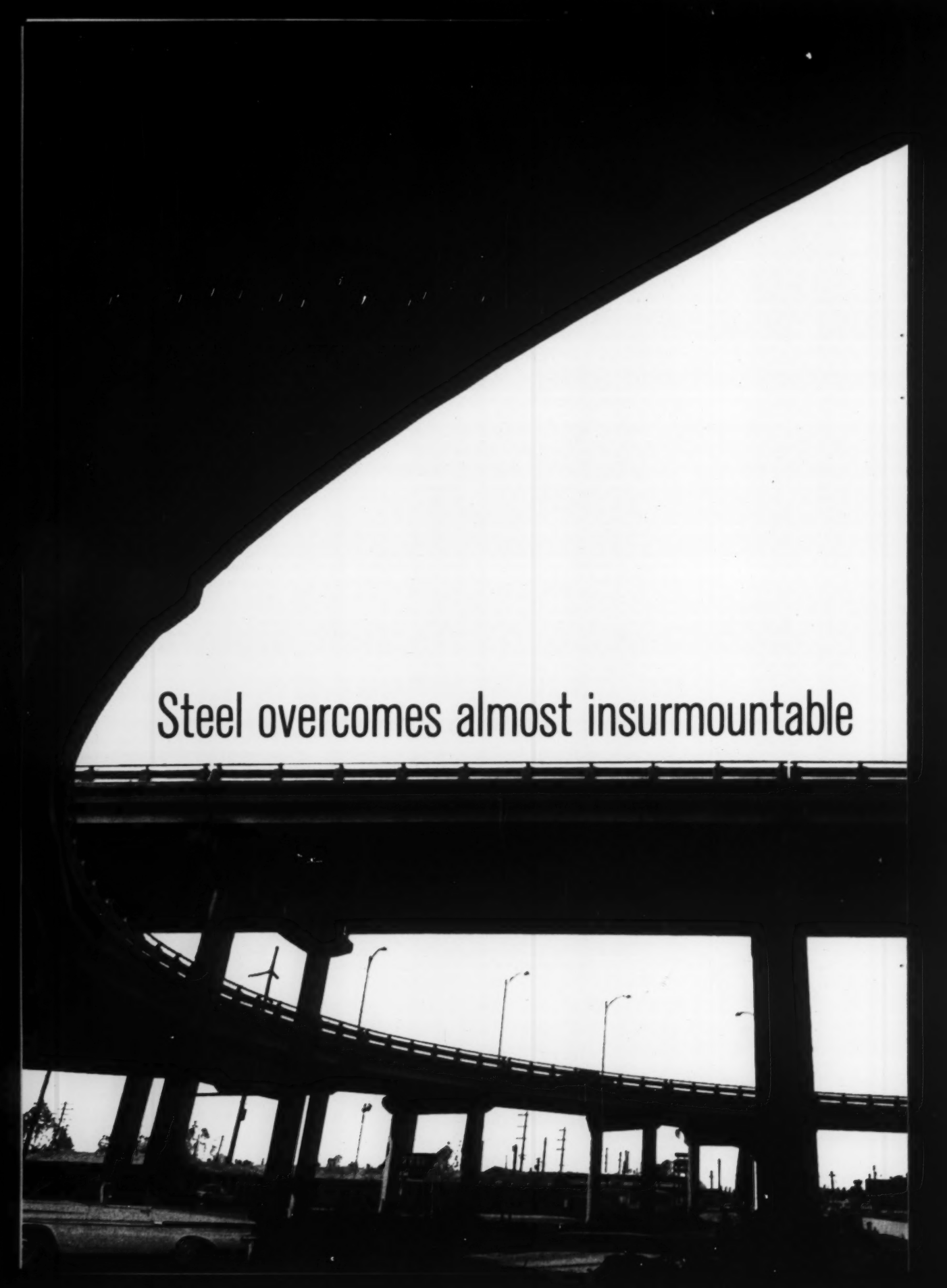
Steel overcomes almost insurmountable

Famous 4-level intersection of Greater New Orleans Expressway at Causeway Boulevard. Built over 11 railroad tracks. Fast erection with steel eliminated serious traffic interruptions. Fabricated by American Bridge Division, using 6000 tons of structural steel.

◀ Intersection showing construction with simple steel beams which reduced costs and saved time.

Mr. Wayne F. Palmer, President, Palmer & Baker Engineers, Inc., Admiral Wm. H. Smith, Vice President and Chief Engineer, and Mr. Kenneth C. Roberts, Assistant Chief Engineer for Design.

USS Steels for Bridge Design

Structural Carbon Steel 33,000 psi minimum yield point	**USS MAN-TEN High Strength Steel** 50,000 psi minimum yield point
USS TRI-TEN High Strength Steel 50,000 psi minimum yield point	**USS "T-1" Constructional Alloy Steel** 100,000 psi minimum yield strength

obstacles in short-span bridge design

at Palmer & Baker Engineers, Inc., Mobile, Ala.

If you want to see how seemingly impossible bridge and highway problems were solved with steel, take a trip around New Orleans and east along the Gulf Coast. In this area, the consulting engineering firm of Palmer & Baker has designed some of the most interesting structures in the country. Last year, with a staff of about 400 people, they handled approximately $155,000,000 worth of Interstate Highway and Bridge projects.

One of their most difficult projects was a 4-level highway interchange and railroad grade separation located on Causeway Boulevard and the Greater New Orleans Expressway. Eleven railroad tracks that couldn't be moved ran through the area. The use of steel permitted the interchange to be built without interrupting railroad traffic. Highway traffic amounts to an average of 65,000 cars daily.

Here is a practical example of the versatility of steel structural members. No difficulty was encountered in moving steel into position and the traffic flowed through without tie-ups. Certainly any other method of construction would have been not only impracticable but considerably more expensive.

Recently Palmer & Baker completed plans for a proposed 78-mile superhighway traversing undeveloped bayou country of Southern Louisiana. The highway will be built literally on top of a swamp. Each of the 18 bridges will be of steel, including the pilings set in the swamp.

Basic advantages of steel construction.

Steel saves time in both engineering and construction.

Steel saves money by reducing foundation costs and speeding up construction.

Steel permits greater clearance, or the same clearance with lower approaches.

Steel can be transported easily and economically to the site.

Steel of the high strength, corrosion-resisting types saves weight, reduces painting costs and cuts foundation costs.

Steel is readily available in any part of the country.

USS, MAN-TEN, TRI-TEN and "T-1" are registered trademarks

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Tennessee Coal & Iron – Fairfield, Alabama
United States Steel Supply – Steel Service Centers
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USS

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The Younger Viewpoint

Committee on Younger Member Publications

Walter D. Linzing, Chairman; 4751 No. Paulina, Chicago 40, Ill.

Zone I	Zone II	Zone III	Zone IV
Donald Kowtko 289 Foxhill Road Denville, N. J.	Albert C. Nelson 250 N.E. 51st Street Miami, Fla.	William R. Walker 4600 Franklin Ave. Western Springs, Ill.	Judd Hull 6000 S. Boyle Ave. Vernon, Calif.

This month's editor is Donald Kowtko, of the Metropolitan Section, who represents Zone I.

Professionalism is a perplexing and vital subject of great concern to both the younger and older members of ASCE. Yet the first step, defining our goal—professionalism, is comparatively easy.

Basic elements of professionalism

E. Lawrence Chandler, then Assistant Secretary of ASCE, in the March 1958 issue of CIVIL ENGINEERING had this to say:

"Practice of a profession is based on specialized knowledge in a particular field of learning. It involves intellectual effort and calls for creative thinking. These are some of the attributes of professionalism. But true professional spirit incorporates a deeper, more fundamental concept. No one can rightfully lay claim to being a professional person unless he is motivated by a desire for service—service to those in his immediate circle of associates and service to mankind. . . . Collectively, a group of men form a true profession only as they command the respect of the public and inspire confidence in their integrity and the belief that they truly are serving the general welfare."

Dr. Eric A. Walker, president of Pennsylvania State University, in the March 14, 1960 issue of *Product Engineering*, points out indirectly why this goal of professionalism seems so elusive to engineers:

"Engineering has become an important basic component of our total culture. This fact gives engineers and engineering a tremendous social responsibility—a responsibility for which they seem unprepared and reluctant to accept. Historically, engineers have prided themselves on their 'know-how' but have been content to let others make decisions and formulate policies. Calling themselves 'servants of society' they have compiled brilliant records of achievement—in a society directed by lawyers, politicians, business executives and, more recently, scientists.

"With a 'how-to' orientation, that is exactly what engineers are, servants, in the basic sense of servile followers and laborers. But engineering has grown too important in our culture and our society for this sort of orientation. Today the engineer needs to become a full participating member of society—a member willing and able to assume leadership where he can lead more wisely than others. He must demonstrate his readiness to accept a leadership role commensurate with the importance of engineering as a social force.

"Until engineers accept this role, they will not be given the public attention that others receive. Policy makers, not mechanics or servants, dominate the headlines. Not until engineers lift their eyes from the drawing boards to look at the effect their designs and inventions have on the life of man—both as it is and as it could be—will they receive the attention that could—and should—be given them."

Suggested solution

The obvious solution, it seems to me, is to revise the engineer's training so that he can more effectively assume the responsibilities of leadership which are his by virtue of this technical civilization he has helped to create.

The Task Committee on Professional Education reported the following in the March 1958 issue of CIVIL ENGINEERING:

"The civil engineer is a professional man, and he must be trained as such. He must therefore have an understanding of the society he lives in and of his fellow man. He must be able to envisage and plan the whole of a project in consideration of its economic structure and utility, its sociological impact, and its technical details. He must be able to present his ideas effectively and defend them. It is essential, therefore, that he have a good general education with the understanding of social sciences and humanities, and a facility in the arts of communication of ideas. To enable the student to derive full benefit from such subjects, he must be made to realize their importance to him, not only as an individual, but as an engineer."

The typical engineer

Before we go further, let us examine the personality, intelligence, abilities and interests of the "typical" engineer. Eugene Raudsepp published a series of three articles dealing with this subject in the December 1959 and January 1960 issues of *Machine Design*. The following summarizes his comments:

Personality: The typical engineer is a practical man who prefers a tangible assignment where he can take direct, uncomplicated steps toward its solution. His sense of immediacy blinds him to larger problems requiring creative leaps into the unknown. He is formal, impersonal, reserved, self-sufficient, and independent. He has little interest in people. Preoccupied with the physical universe and the manipulation of things, he prefers to withdraw from the social world to the world of objects and ideas. He is not a good diplomat and often lacks communication skills. He does not like to assume leadership in group activities, is vocally restrained, and has inhibited social address.

Interests: Engineers are neither service- nor human relations-minded and they are primarily nonverbalists. Although engineers' median scores on intelligence tests fall at approximately the 90th percentile of the general population, their favorite periodicals are the mass-circulation magazines. They avoid both the high brow, cultural periodicals and the low-quality magazines, thus revealing their characteristically middlebrow preferences. Few engineers read classics or semi-classics, and even fewer read books on philosophy, psychology, social science, public affairs, and fine arts. They are heavy practitioners in dating, dancing, movies, parties, and other activities. Mechanical hobbies dominate, followed by sports and outdoor life.

The paradox

Understanding the elements of professionalism, in particular (1) the desire to serve mankind, (2) the need to become a full participating member of society, (3) the willingness to accept leadership, and (4) the need to think creatively encompassing a broad scope of human needs, it is obvious that today's "typical" engineer falls far short of meeting these requirements.

In fact, all these elements are in direct conflict with his personality and interests. We must, therefore, conclude that today's "typical" engineer cannot achieve the goal of professionalism since it is so diametrically opposed to his personality.

Can the obvious solution (i.e., training in the social sciences, humanities and the art of communication) overcome the "natural grain" of the engineering student's personality, or will even this fail to help the future "typical" engineer make the transition from a "servile follower" to a professional man willing to "accept the leadership role commensurate with the importance of engineering as a social force"?

The eventual outcome may very well be a division into two distinct groups of engineers, with the small group the "true professional"–the unusual engineer with the desire to serve mankind—and the large group the "servant of society"—the "typical" engineer of our generation. Does this division possibly exist even today without being formally recognized as such?

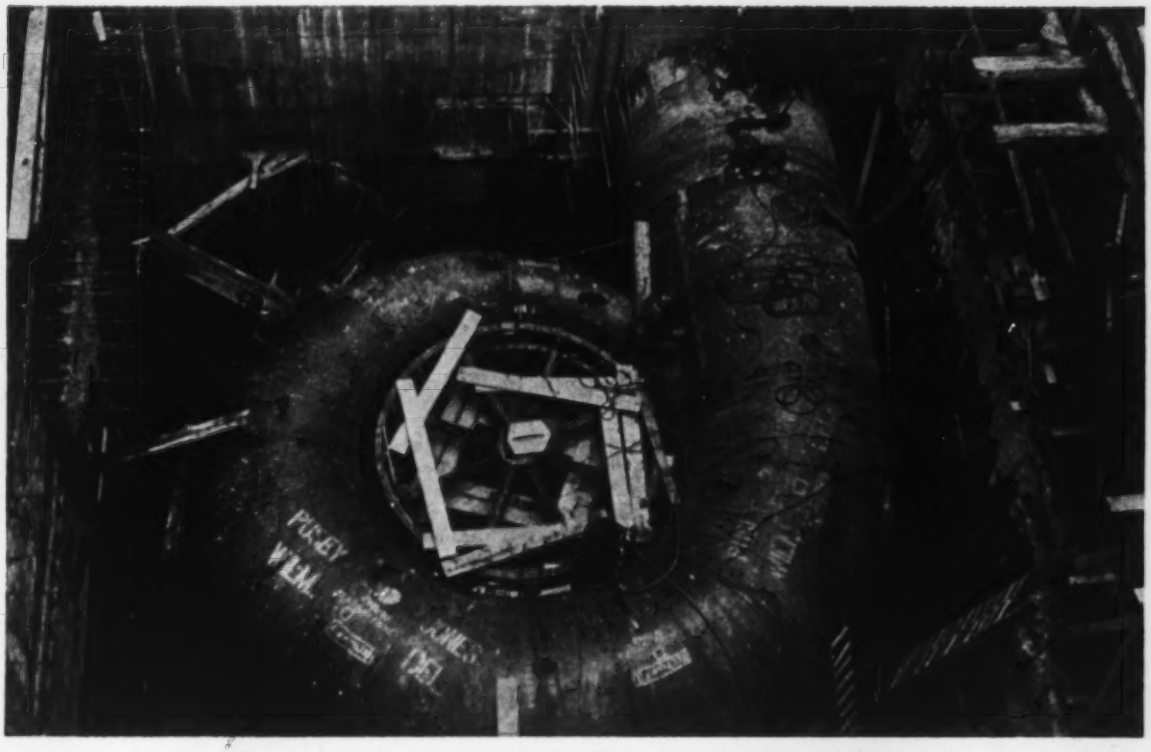

Plate steel spiral scroll case during installation at the Prospect powerhouse.

Niagara-Mohawk picks a Leffel Turbine for new Prospect powerhouse

Prospect powerhouse, Niagara-Mohawk's 87th hydroelectric generating plant.

A Leffel spiral case, vertical shaft turbine is the heart of the Prospect Development powerhouse recently completed by the Niagara-Mohawk Power Corporation near Utica, New York. This turbine is rated at 23,900 H.P. at 180 R.P.M. under a 135 foot net head.

Prime factors in Niagara-Mohawk's selection of a Leffel turbine for Prospect were Leffel's long experience in water power development and the proven ability of Leffel turbines to operate at high efficiency year-after-year with absolute reliability.

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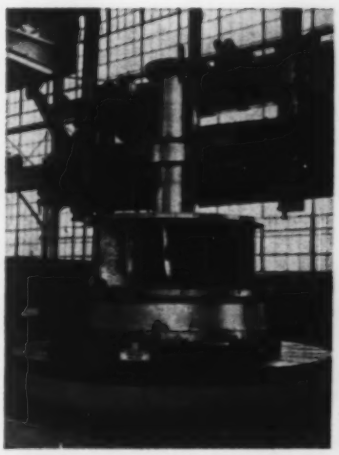

Runner and shaft for the Prospect turbine on Leffel's 24' vertical boring mill.

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BY-LINE WASHINGTON . . . . .

In the 86th Congress now adjourned practically every bill of interest to civil engineers—outside of normal appropriations measures—failed of passage. Most of them failed even to get consideration on the floor. And those that did get to the debate stage foundered on lack of understanding of the issues presented, lack of sufficient facts to convince enough Congressmen, and bad generalship in the legislative battling.

Basically, that is what happened to such things as federal school aid, the minimum wage bills (which would have included some engineering employees), the attempt at tax relief for the self-employed through deductions for self-financed retirement plans, the attempt of labor unions to get approval for "common situs" picketing, restrictions on state taxation by states on out-of-state business activities, and many others.

Major measures concerning urban renewal and housing failed because the facts were against them. The figures being gathered and processed by the Census Bureau, for example, seem to show that housing has been outrunning population increases by a considerable percentage, there are far fewer "doubled up" families now than ever before, there is plenty of rental and sale property available in most cities. In the face of such evidence, Congress was simply not convinced that there was need for further great infusions of federal money into the housing field at this time.

A few matters were introduced much too late for any consideration. But it is as certain as anything can be in Washington that these will come up again next session. They include:

1. Senator Hubert Humphrey revived the idea of a federal "department of science." This proposal has been defeated several times in one form or another (by opposition of most scientific and technical groups, who see further confusion to an already difficult situation). Senator Humphrey's bill would create a "commission" that would "study the advisability" of such a federal department.

2. Rep. Laurence Curtis, of Massachusetts, introduced a bill aimed at protecting the New England interstate water compact from Congressional interference, but would similarly protect other interstate agencies. In its essential paragraph, the proposed bill would amend present law, which gives Congress the right to alter, amend, or repeal interstate compacts. The governors of many states—particularly New York and New Jersey whose Port of New York Authority is under attack—have expressed serious concern over such investigations, as an invasion of states' rights.

3. A suggestion for establishment of an "institute" under the aegis of the Tennessee Valley Authority, to provide training for foreign engineers and public officials in development of water and power resources.

4. A series of late-session attacks on the Civil Defense program, and on suggestions for construction of large public shelters, as an "utterly senseless boondoggle." Led by Ohio's Senator Young, these attacks seem to presage a serious effort to curtail civil defense activities.

On the side of measures actually passed by Congress, construction interest was confined to appropriations bills. Just for the record, they went this way: For Army Civil Works, $930.8 million (an all-time high); for the Bureau of Reclamation, about $225 million, including funds for five "new starts"; for housing and education, a one-year extension of home improvement programs—$500 million for college housing, $50 million for the community facilities program; for stream pollution clearance (part of the appropriation for the department of Health, Education and Welfare) $45 million—with authority to request $5 million more as a supplemental figure; and for the Atomic Energy Commission's construction program, $211.5 million.

• • •

Highway engineers held about steady in the salary department in 1960, according to the sixth survey (the first since 1958) by the American Road Builders Association. The ARBA found that in the 50 states, the average pay of the highway department's chief administrative officer was $15,817; chief engineers got $14,311; deputy chief engineers, $12,002; bridge engineers, $11,140; construction engineers, $11,345; district or division engineers, $10,567. Top salary for a chief executive officer was New Jersey's $22,000; top for a chief engineer was Illinois' $22,800. Low men on the salary pole were Alabama's "engineering aides" at $3,000 a year.

• • •

The Urban Renewal Administration is undertaking to instruct local planning groups on selecting consulting engineers, through issuance of its "Technical Guide No. 1, Selecting Consultants for Project Planning." The Administration says, "When it has been decided that consultant services are needed, it will pay a community to carefully select the firm to be retained." It then gives a series of steps to be followed as to ascertaining qualifications, reaching a firm agreement, fees and the like. Additionally, the URA offers to supply contract forms to be used as a basis for negotiation with consultants as to fees and duties.

• • •

Already a formidable competitor for technical and engineering personnel, the U.S. government moved even more strongly into competition, armed with newly-liberalized pay allowances. Under the terms of Public Law 86-587, which became effective August 25, the government can now offer to pay travel and moving expenses for new employees and student-trainees when they have completed college work and become full-time professional career employees. Jobs covered by the new offer include natural and mathematical sciences, engineering and architecture, landscape architects, geodesy and statistics.

• • •

The Senate's Select Committee on National Water Resources will have a report ready for Congressional consideration by the time Congress re-convenes for a new session next January.

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THE READERS WRITE

Use of shear connectors in composite sections

To THE EDITOR: A question that has been puzzling me is the use of shear connectors for composite beams made of rolled sections and concrete slabs. In all the literature I have seen on this subject—both that put out by ASCE and commercial material—the shear connectors are carried to the ends of the beams, sized and spaced to resist horizontal shear between slab and beam.

The result is that there are large numbers of closely spaced shear connectors toward the ends of the beams. Since this device—composite construction—for strengthening a rolled section is analogous to the use of cover plates, perhaps some reader can tell me why we are not treating these two schemes similarly? Why not eliminate the shear connectors outside the length of the beam where composite action is required to resist bending?

GEORGE T. WILLIAMS, M. ASCE

Louisville, Ky.

Another civil engineer of the Civil War period

To THE EDITOR: I heartily endorse the idea of Robert S. Mayo, F. ASCE, in the July issue, p. 69, that articles about notable civil engineers of the Civil War period would be of great interest.

No doubt there is much information—and some very good books—that should be listed with such articles. I hasten to add to the list of names that of James Buchanan Eads, M. ASCE (1820-1887), builder of the Eads Bridge across the Mississippi at St. Louis. As a student, engineer, financier, constructor, and inventor he had much influence and attained an international reputation in a relatively short time. During the Civil War he constructed ironclad steamers and mortar boats for the Federal Government.

An excellent biography of him, *Road to the Sea*, by Florence Dorsey (Rinehardt and Co., Inc., about 1947) unfortunately is out of print.

H. L. GOODELL, F. ASCE

Montgomery, Ala.

Factors of safety for concrete-pipe sewers

To THE EDITOR: Changes in ASCE Manual 37, "Design and Construction of Sanitary and Storm Sewers," were announced in the July issue, p. 79. These changes, which involve the factor of safety to be used in the design of reinforced-concrete pipe sewers, are a regrettable step backward. The application of the same factor of safety to non-reinforced and to reinforced concrete pipe is an archaic concept that fails to take into account the unique characteristics of the reinforced product.

When a reinforced concrete pipe is subjected to vertical load, the first visible effect is the development of longitudinal cracks on the inside surface at the bottom and top. These first cracks are very fine and difficult to see; therefore the American Society for Testing Materials established a width of 0.01 in. as a measurable crack that can be identified uniformly regardless of lighting conditions, surface texture and acuity of observer's vision. This crack width has also gained wide favor as a limiting value that should not be exceeded in the design of pipe installations.

As loads are increased beyond the 0.01-in. cracking load, the top and bottom cracks open wider and cracks appear in the outside surface near the ends of the horizontal diameter. Still further load increases cause the protective cover over the reinforcement on the inside at the top and bottom to loosen and spall off, and the reinforcement may be exposed. Finally, the limit of load-bearing capacity is reached. The load at this limit is called the ultimate load.

The spread between the 0.01-in. crack load and the ultimate load varies widely, depending on methods of manufacture, strength of concrete, accuracy of steel placement and numerous other factors. In some pipes the 0.01-in. crack load may be as low as 40 percent of the ultimate or even less. In others, particularly those in which radial ties or "shear" reinforcement have been incorporated, the 0.01-in. crack load may be nearly as great as the ultimate.

To illustrate the inappropriateness of this announced change, suppose a certain lot of pipe is tested and it is indicated that the 0.01-in. crack strength is 50 percent of the ultimate. If the field installation is designed on the basis of a factor of safety of 1.5 applied to the ultimate, the actual load on the pipe may approach 67 percent of ultimate, whereas the cracking load is 50 percent. Therefore the cracks in the pipe as installed may open up well beyond 0.01 in., and actual spalling of the protective cover may develop. It is reasonably certain that the person or persons responsible for this change would not consider that such a pipeline was well designed.

On the other hand, if the 0.01-in. crack and the ultimate strengths of the pipe were nearly the same, it would not be prudent to design on the basis of cracking strength. Therefore, a design based on 80 percent of the ultimate (a factor of safety of 1.25) or 75 percent (a factor of safety of 1.33) would appear to be prudent, and yet permit taking reasonable advantage of the superior characteristics of such a high-quality product.

M. G. SPANGLER, F. ASCE
Research Prof., Civil Eng., Iowa State Univ. of Science and Tech.

Ames, Iowa

Symposium on engineering education recommended

To THE EDITOR: I have perused with avid interest Dr. R. E. Fadum's article, "The Case for Professional Schools of Engineering," in the August 1960 issue of CIVIL ENGINEERING, p. 80.

For those readers who might be interested in a more thorough study of all aspects of one corner of this field, I heartily commend the symposium on engineering education, the content of the entire issue of the *Journal of the Construction Division*, vol. 85, No. CO1, dated February 1959. Its list price is $3.00, with the usual 50 percent discount to ASCE members.

M. D. MORRIS, F. ASCE
Chairman, Publication Committee Construction Division

New York, N. Y.

Madison Canyon slide and dolomite "block"

To THE EDITOR: The article by Keith R. Barney on the "Madison Canyon Slide," in the August issue, p. 72, is excellent although marred by a misuse of the term "dike." On p. 73, in the diagram, Fig. 2, a geological cross-section through the slide, "inferred limits of dolomite *dike*" should read "inferred limits of dolomite *block*."

Dolomite is a sedimentary rock, or a metamorphosed sediment and occurs in beds, or layers. A dike is a tabular cross-cutting intrusion, almost always of igneous material. I have followed the events connected with this slide with great interest. The Madison Canyon slide apparently occurred in an area of Pre-Cambrian metamorphic rocks, largely sedimentary but with some volcanic rocks probably. The term "block" should have been used in place of "dike" in this case.

GRAY EDWARDS, M. ASCE
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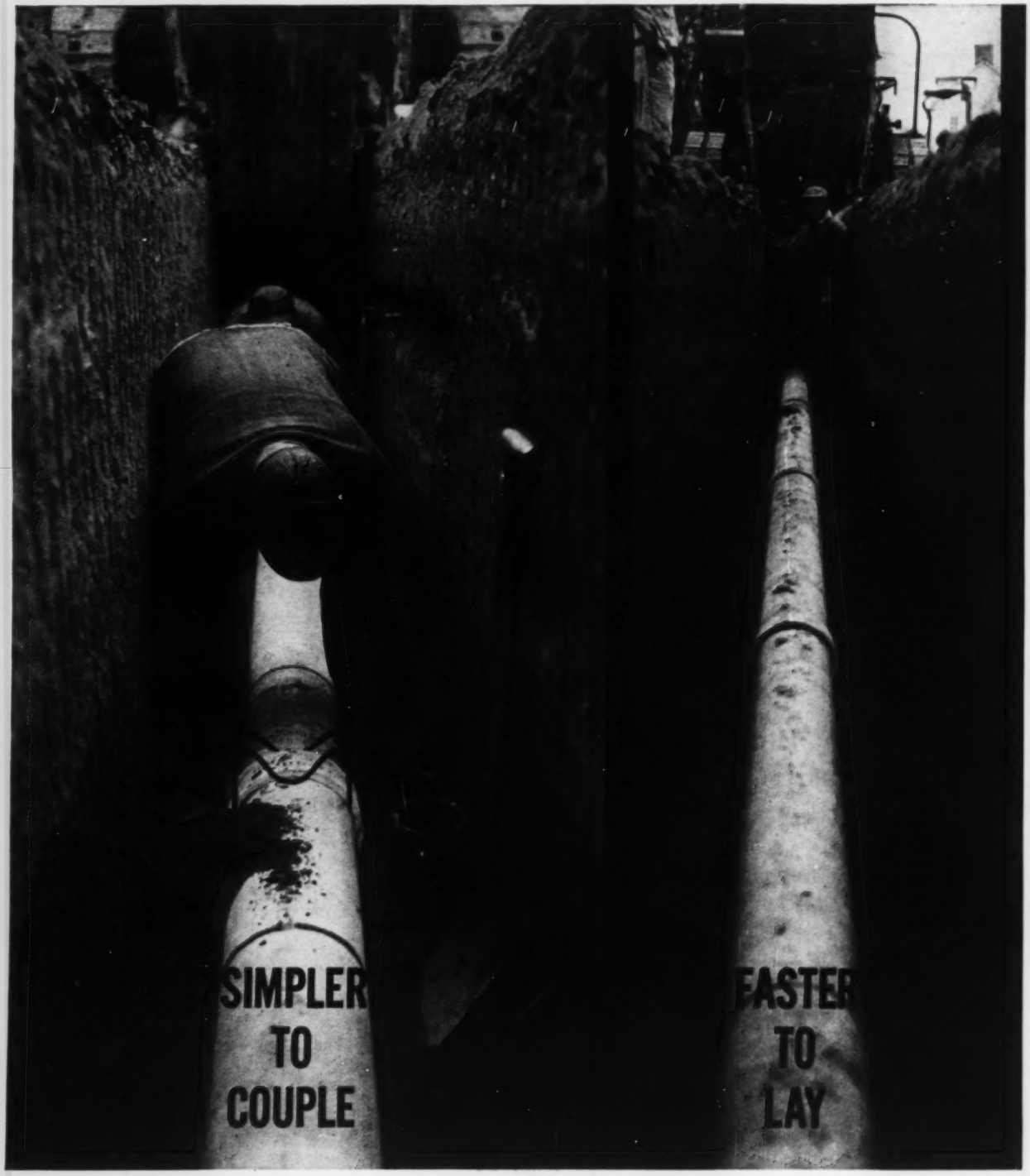

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News Briefs . . .

Construction Spending Declines in August

The value of new construction put in place in August amounted to $5.2 billion, according to preliminary estimates of the Bureau of the Census of the U.S. Department of Commerce. The August seasonally adjusted annual rate of new construction was $54.5 billion—1 percent less than the equivalent rate for July and 5 percent below the August 1959 level. Construction expenditures for the first eight months of 1960 totaled $35.5 billion—3 percent less than the total for the first eight months of last year.

New private construction expenditures this August came to $3.5 billion—about the same as in July but 8 percent under the August 1959 level. For the eight-month period of 1960 expenditures were down 9 percent from the comparable period of last year. Spending for public construction this August amounted to $1.6 billion—2 percent more than in July and 1 percent above August 1959. However, the cumulative total for the first eight months was 7 percent below last year's total for the period.

The joint agencies note that their estimates reflect the revised, higher level of housing starts recently introduced by the Census Bureau and the inclusion of Alaska and Hawaii.

National Water Pollution Conference Set for December

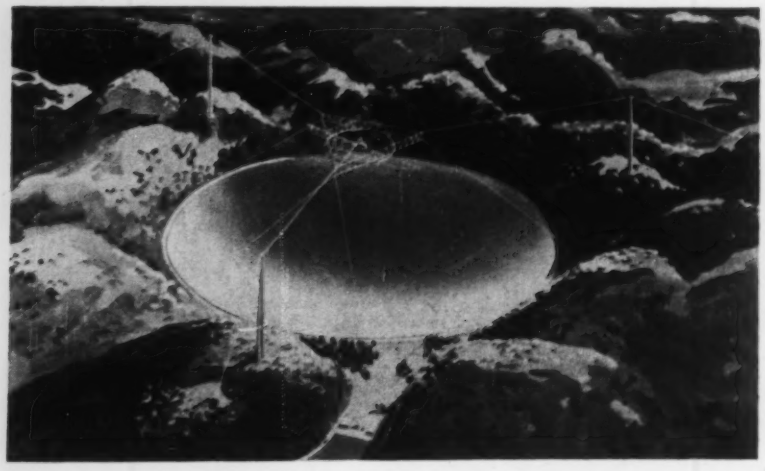
Representatives of some 300 national groups and organizations will meet in Washington, December 12-14, to attack one of the nation's major health and economic problems—water pollution. This first government-sponsored Conference on Water Pollution ever held will be called to order by Surgeon General Leroy E. Burney at conference headquarters, the Sheraton-Park Hotel. The conference is being held at the request of President Eisenhower as a "forum in which all concerned can confront and better appreciate their mutual responsibilities for solving the pressing problem of pollution of the nation's watercourses."

Despite the great advances of the past 50 years in pollution control and correction, sanitary engineers think that from a health standpoint the nation's water problem is more serious than it was a generation ago. The exploding population, the expanding economy, and the ever-increasing industrial pollution are seen as some of the reasons.

Public Health Service officials concerned with the vital conference are Mark D. Hollis, Assistant Surgeon General and chief engineer of the Service; Gordon E. McCallum, chief of the Water Supply and Pollution Control Division; and Frank A. Butrico, executive secretary. All are Fellows of ASCE. As announced in the July issue (page 75), ASCE is represented on the Steering Committee by Edward J. Cleary, F. ASCE, executive director of the Ohio River Valley Sanitation Commission.

Giant Radio Telescope to Be Built in Puerto Rico

This astronomical radio telescope consisting of a giant reflector will be built at Arecibo, Puerto Rico. Scheduled for completion in 1961, the telescope will make it possible to study the upper atmosphere, the composition of space and the solar system by radar methods, and also to send and receive radio signals from deep within the universe. The reflector, consisting of a spherical surface of 870-ft radius, will utilize a large, natural sinkhole as a bowl, permitting more economical construction. Use of a fixed reflector and movable line feed to receive or transmit radio signals makes it possible to avoid the usual structural difficulties encountered in supporting large movable dishes within rigid reflection tolerances. Engineering design and supervision are by a joint venture consisting of von Seb, Inc., the Developmental Engineering Corp., Severud-Elstad-Krueger Associates, and Praeger-Kavanagh, with T. C. Kavanagh, F. ASCE, acting as chief engineer. Construction is under the general direction of the Cambridge Research Center (U.S. Air Force), with Cornell University serving as the major contractor. Financing of the $6,000,000 project is provided by the Advance Research Projects Agency.



Financing Completed for Chesapeake Bay Project

The Chesapeake Bay Bridge and Tunnel District has completed the underwriting of a $200 million revenue bond issue to finance a 17½-mile bridge-tunnel project across the mouth of Chesapeake Bay near Norfolk, Va. The crossing will replace a ferry that requires an hour and 35 minutes for the trip and has long been a traffic bottleneck. The new facility will cut this time to 35 minutes and eliminate the long wait in line for the ferry. Construction will be completed in about three years, and is expected to cost $139 million.

Two tunnels, two steel bridges, a causeway, and 11.6 miles of precast, prestressed concrete trestle comprise the project, which will link Cape Charles, Va., with Chesapeake Beach near Norfolk. This new facility—the longest bridge-tunnel project in the world—will pave the way for a new coastal highway which will provide the most direct route between New England and Florida. The project will involve the construction of several artificial islands, and these will house a restaurant and several fishing piers.

The project was designed by the St. Louis consulting engineering firm of Sverdrup & Parcel. Wilbur Smith and

Associates, New Haven, Conn., prepared the traffic forecasts. Construction contracts for the tunnels and trestle have been signed with a joint venture, consisting of Merritt-Chapman & Scott Corporation, Raymond International, the Tidewater Construction Company, and Peter Kiewit Sons Company. The contractor for the two bridge superstructures is the American Bridge Division of the United States Steel Corporation.

NSF Grants for Antarctic Research

Grants totaling $3,175,096 will aid scientific research in the Antarctic beginning in October, according to an announcement from Alan T. Waterman, director of the National Science Foundation, which administers the U.S. Antarctic Research Program. Antarctic research money goes to several government agencies as well as a number of colleges, universities, and scientific institutions. Scientific research under the new grants will be carried on during the coming austral summer (winter in the United States) and the succeeding austral winter. About 120 scientists and their technical associates will spend the summer in Antarctica, and part of the group will remain for the winter.

According to Dr. Waterman, many of the investigations will be international in scope, with scientists from all over the world taking part. "This," he said, "is in keeping with the fruitful pattern of cooperative research for peaceful purposes established during the International Geophysical Year and which would be continued under the proposed Antarctic Treaty recently ratified by the United States Senate."

Fields investigated in the Antarctic research program include biology, geodesy and cartography, geology, geophysics, meteorology, oceanography, and seismology.

Corps of Engineers' Offices to Merge

Two sizable Army installations in Tennessee became one on July 1, with the merger of the Nashville and Tullahoma Districts of the Corps of Engineers. In effect, the Nashville District is absorbing the Tullahoma District, but will maintain an area office there for continuing construction at the Arnold Engineering Development Center. Lt. Col. William C. Langley, now Tullahoma district engineer, will serve as area engineer at Tullahoma. The estimated value of work scheduled for the Arnold Engineering Development Center in the coming fiscal year will be in the neighborhood of $9,000,000.

California Builds Its First Navigation Locks

California's first navigation locks, depicted under construction, are part of a barge canal to be included in the new Sacramento River Deep Water Channel Project. This project, to be finished over a five-year period, will also include a harbor, turning basin, and 43 miles of deep-water channel. It will connect the Sacramento area directly with the seaports of the world. The inside or face walls of the barge locks will be 580 ft long and 86 ft apart. They are made of steel sheetpiling 60 ft long. The sheetpiles are driven to serve as a cut-off and fix their lower ends in the soil. They are held back at three levels by rods of Mayari R Steel, manufactured by the Bethlehem Steel Co. Short sections of steel sheetpiling serve as anchors for the rods. The $6.5 million contract for the current phase of construction is held by a joint-venture group called Lock-Bridge Constructors. The Army Corps of Engineers designed the project and is supervising its construction.

Japan Host to World Conference on Earthquakes

The Second World Conference on Earthquake Engineering—held in Tokyo and Kyoto, Japan, during the week of July 11-18—was attended by 120 delegates from foreign countries as well as 400 Japanese experts in the field. The foreign delegation represented 27 countries, including Russia, Roumania, and East Germany. There were 32 in the U.S. contingent, and 23 of the group presented papers. In addition to 124 timely papers, the program featured visits to university laboratories and to structures that have been subjected to earthquake damage.

The largest group of papers dealt with structural response to earthquake ground motion, including such aspects of the problem as elastic and inelastic response of multi-degree-of-freedom structures and energy loss. Other sessions dealt with earthquake engineering instrumentation, soil and foundation conditions in relation to earthquake problems, seismicity and earthquake ground motion, earthquake-resistant design and construction, and building regulations. Damage reports were presented on recent earthquakes in Chile, Morocco, Mexico, India, Iran, and the United States (the 1959 earthquake in the Yellowstone area).

Preprints of the papers were available at the conference. The Proceedings (124 papers) will be issued in three hard-cover volumes, at a price of $17. They will be available in about four months and may be ordered from the Intelligence Section, Science Council of Japan, Ueno Park, Taito-ku, Tokyo, Japan. A volume assembling the current regulations of thirteen countries and entitled "Earthquake-Resistant Regulations of the World," was issued at the conference. It also is available from the Science Council of Japan at a price of $5.

The widespread interest in the conference emphasizes the fact that destructive earthquakes are a truly international engineering problem and that the protection of structures against strong ground shock must be given extensive study during the coming years. A committee of 28 members, one from each country represented at the conference, was appointed to act as an international body to promote the development and dissemination of information on earthquake engineering. John Rinne, F. ASCE, is the United States representative.

The committee's first item of business will be the preliminary arrangements for the Third World Conference to be held in 1964. The First World Conference was held in San Francisco in 1956. It was organized by the Earthquake Engineering Research Institute, which has its headquarters at California Institute of Technology.

Urban Renewal in Paris

Principal buildings in the Maine-Montparnasse Project, a kind of French "Rockefeller Center". The 50-story building in the foreground will be Paris' first true skyscraper.

As a first major project in the plan to reorganize the Paris area, a French equivalent of Rockefeller Center is about to surge up close to the heart of the nation's capital.

In the 50-acre project bounded by the bridge of the Boulevard Pasteur and Place de Rennes, and by the Avenues Vaugirard and Maine:

- The main Montparnasse railroad station and subsidiary buildings are to be razed, and a new, consolidated station will be built on the periphery of its present site.
- On the site of the present Montparnasse station, a 50-story office building will go up.
- On its lower levels, this development will have convention halls; hotels; stores; a tourist center; recreation and rest rooms; restaurant and bar; cinema and swimming pool.
- Six other 18-story buildings in the project are to provide a great many moderate-cost apartments
- Under the buildings and esplanade garden will be railroad offices and a parking area with a 1,300-car capacity.

This development is part of a three-way plan to improve the seriously overcrowded French capital. The first stage aims at reducing the immigration flow to Paris from the Provinces by industrial decentralization and provision of new facilities and attractions in various areas of the country. The government will continue to attract industry to the Provinces from Paris by offering free sites, tax benefits, bonuses, and other inducements.

The second part of the Ministry's plan aims at carrying out a reorganization of the suburban areas in the 50-mile radius around Paris. Three new centers to house and service 200,000 are to be constructed outside of Paris, offering all the facilities found in Paris plus pure air and green surroundings.

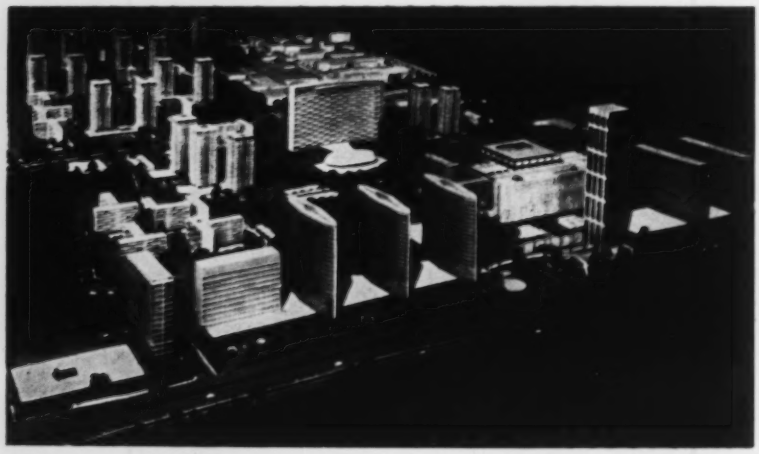
The third part of the plan is called the "reconquest of Paris." This part of the program will be spurred on by the "Radio City-type" development previously described and shown in the accompanying photo.

Urban Renewal in California

Century City, a new self-contained community for 30,000 people, will soon rise on an old California movie lot. Over $250 million worth of buildings will be constructed to form this model "city of tomorrow" which will represent the largest privately financed urban development in the United States.

To be built on a 265-acre site in Beverly Hills, Century City will be a joint venture of Webb & Knapp, Inc., and the Aluminum Company of America. The transaction is viewed as a pioneering step in the evolution of advanced engineering and construction techniques employing aluminum, and as an innovation in industrial investment opportunity in urban real estate development.

Century City will comprise high-rise apartment houses, offices, stores, a hotel and other structures to be erected during the next decade. Present plans call for ground breaking for the first buildings in the spring of 1961.



Century City will feature a new design concept of structures of aluminum, glass, and other contemporary materials. The model city is being master-planned by Welton Becket and Associates of Los Angeles.

Federal Urban Renewal Council

Formation of a Federal Urban Renewal Council has been announced by David M. Walker, commissioner of the Urban Renewal Administration. Composed of representatives of industry, city planning, business, and higher education, the Council will provide leadership and assistance in generating new solutions to age-old redevelopment problems.

At its first meeting the council set up five subcommittees to consider the problems of public and private financing of urban renewal, conservation and rehabilitation, middle-income housing, mass transportation needs, comprehensive urban planning, and Federal-local relationships.

More Cities Undertake Urban Renewal Projects

More new urban renewal projects—184—were approved during the fiscal year ended June 30 than in any other 12-month period since the beginning of the Federal aid program in 1949. This brought to 797 the number of projects actually under way or completed. During the same period 90 new cities entered the program

and raised to 456 the total number of participating communities.

An all-time 12-month high was also achieved in the amount of capital grant funds reserved or earmarked for projects —$334.5 million. The total grant figure on June 30 was $1,648,000,000. Other 12-month highs include: land acquisition, 3,038 acres; land disposition, 811 acres; demolition of dwelling units, 34,977; relocation of families, 24,496.

The addition of 356 new localities brought to 1,369 the total for which planning assistance has been approved since the inception of the program in 1954. Project applications in the aggregate amount of $3,750,000 were approved. Project completions numbered 61.

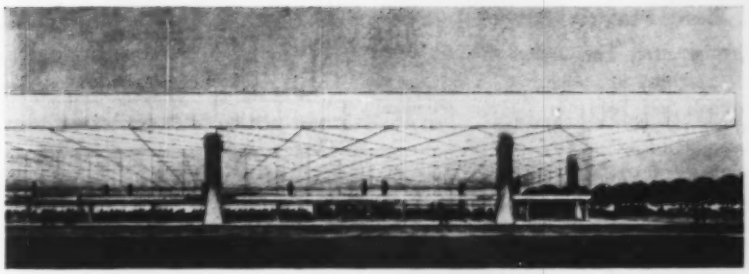
Ford Foundation Gives Funds For Transportation Study

To stimulate long-range planning and development in urban transportation the Ford Foundation has announced a grant of $500,000 to the Rand Corporation. A three-year exploratory study of urban transportation throughout the U.S. will be conducted by Rand, a private nonprofit research and development organization noted for its research on major problems of national defense and strategy.

Rand's present research program will consist of an engineering survey of current and projected technology; an analysis of costs and the benefits of present urban transportation systems as compared with other systems that might be devised; and an analysis of the function of the modern city.

Other Ford Grants For Urban Studies

The Foundation also announced a number of other grants dealing with urban affairs on the local, regional, and international level. These include: a $550,000 grant to the University of Minnesota to expand the scope of the Upper Midwest regional study; a $400,000 grant to the Regional Plan Association for a series of experimental projects in the New York metropolitan area; a $175,000 grant to the University of Pennsylvania for an analysis of the 1960 census data relevant to urban migration; a $150,000 grant to Wilkes College to support three projects for the redevelopment of the Wilkes-Barre area; a $125,000 grant to the University of Illinois for a program of university service to the state's urban areas; and a $140,000 grant to Athens Technological Institute (Greece) for a training program in urban planning, using the experience of the building of a new capital for Pakistan.



Design for Multi-Airline Terminal at Idlewild

This building—the design of I. M. Pei, of I. M. Pei & Associates, New York City—is the winner in a Port of New York Authority competition to help select an architect for the multi-airline terminal building, to be built at New York International Airport. The design calls for a striking city-block-long rectangular structure with two-story-high glass walls on all four sides, giving a feeing of complete openness. The flat-space frame roof, supported by massive free-standing pylons outside the building walls, projects beyond the pylons. It is made of pre-assembled steel pipe tetrahedrons, topped by a concrete slab, with tension cables and steel-pipe compression members on the under side. Mr. Pei—a M.I.T. graduate and former member of the engineering faculty there—has been the architect on many notable projects.

Renewal Project for Downtown Minneapolis

A $43,000,000 master development plan for the obsolescent downtown area of Minneapolis has been presented to the City Housing and Redevelopment Authority. If the plan is approved, it would result in replacing 40 percent of the lower downtown area with five major construction projects, all privately financed.

Known as the Gateway Center Proposal, the project would include a seventeen-story, 370-room Sheraton hotel, to cost $9,500,000; a $7,000,000 home office for the Northwestern National Life Insurance Company; a $2,000,000 area office and training school for the International Business Machines Corporation; a $22,000,000 complex of apartments overlooking the Mississippi; and a $2,000,000 landscaped plaza, to include restaurant, recreation, and entertainment facilities.

If the project is approved, it would be submitted to the Federal Urban Renewal Administration, which would finance 75 percent of the redevelopment costs.

BRI to Have Program on Preassembled Components

A research correlation conference on "preassembled components" in modern building will be a highlight of the Building Research Institute's fall conference, to be held at the Shoreham Hotel, Washington, D. C., November 15-17. Developed under the chairmanship of Leon Chatelain, a Washington architect, the three-day program will also include a session on structural foams; a conference-workshop on "Fasteners and Anchorage Devices for Industrial Curtain Walls"; and a conference on building research developed by the Institute's Research Committee.

Information about the program may be obtained from Harold Horowitz, Assistant Director for Technical Program, Building Research Institute, 2101 Constitution Avenue, Washington 25, D. C. The program will be the third in the Institute's newly inaugurated series of semiannual, multi-subject conferences.

The BRI is a unit of the Division of Engineering and Industrial Research of the National Academy of Sciences-National Research Council.

Kaiser Company Renames Its Construction Branch

To define more accurately the scope of its activities, the Heavy Construction Division of the Henry J. Kaiser Company has been renamed Kaiser Engineers International, division of Henry J. Kaiser Company. As general manager of the newly named international division, John Hallett will be responsible for all the company's engineering and construction activities outside the United States and Canada.

Its international projects include the great Snowy Mountains hydroelectric plant in Australia; the Volta River hydroelectric project in Ghana; and aluminum and cement facilities in India.

G.E. to Provide Power Equipment for Atlas Bases

Tailormade power equipment for the nation's first "hard based" Atlas missile squadrons will be supplied by the General Electric Company. All electrical power for the new missile-launching sites will be provided by specially designed three-phase generators, part of the electrical equipment to be built by General Electric under the terms of two recent contracts with the Corps of Engineers totaling about $1.5 million. In military terminology, "hard bases" are those built underground and designed to withstand almost anything except a direct nuclear hit.

Connected to diesel engines, the generators will power maintenance checkout and launching equipment, measuring and tracking devices, missile and personnel elevators, fuel transfer and loading pumps, and associated equipment. They will assure the Air Force a series of self-sustaining attack bases capable of operating indefinitely in the face of complete power blackouts. One engine-generator set will supply all the power needed at each launching site, with a second set as a standby to help assure continuous operation.

Six bases, each housing an Atlas squadron of nine launching sites, have been authorized. The sites chosen are the Plattsburgh (N. Y.) Air Force Base; the Lincoln (Nebr.) Air Force Base; the Schilling Air Force Base at Salina, Kans.; Dyess Air Force Base, Abilene, Tex.; Walker Air Force Base, Roswell, N. Mex.; and Altus (Okla.) Air Force Base. A single "hard" test site is being built first at Vandenberg Air Force Base in California.

Delivery of all electrical equipment to the six Atlas bases is to be completed by May 31, 1961.

Experimental Mechanics Conferences Set for 1961

The field of experimental mechanics will be covered by two international conferences scheduled for the week, October 29-November 3, 1961.

An International Symposium on Photoelasticity will be held, at Illinois Institute of Technology, Chicago, October 29-31, and an International Congress on Experimental Mechanics will be held in New York City, November 1-3.

Though these conferences seem far in the future, papers for them are due before January 31, 1961. Manuscripts for the New York meeting should be sent to: Dr. Roscoe Guernsey, Jr., Chairman, Publications Committee, Society for Experimental Stress Analysis, General Engineering Laboratory, General Electric Company, Schenectady 5, N. Y. Those for the Chicago meeting go to: Dr. Paul D. Flynn, Secretary, International Symposium on Photoelasticity, Illinois Institute of Technology, Chicago 16, Ill.

The conference papers will be published after they have been reviewed.

EXAM GEMS

by Reggie Strashu

R. ROBINSON ROWE, F. ASCE

EXAMGEN No. 15 appeared to be a rather simple beam problem disguised as a floating barge carrying two eccentric distributed loads (Fig. 1 *a*). The disguise fooled only those who deserved to be fooled. Like Will Fale.

Will had flunked nine exams, learning in the process that inhuman examiners are human enuf to err, so that some vital data are omitted from at least one problem of each set. Seeing no dimension between the 20-T load and the bow, he scaled it at 12 ft, making the barge 64 ft long. Weighing $64^{\#}$ and carrying $64^{\#}$, this length was very convenient. Noticing next the 2-ft draft, he computed the width of the barge

$$b = 128000 / (2 \times 64 \times 62.5) = 16 \text{ ft}$$

When that came out even, he was even surer of the length, even tho, as he noticed later, the width was not needed at all. Being a fair hand at shear and moment diagrams, he drew them (Fig. 1 *b,c*) without trouble, and noted with satisfaction and confidence that all maxima came out even and were located at even feet from the stern. Since the problem didn't ask for an explanation of the 64-kip-ft moment at the bow, he gave none. So Will Fale did.

Ernest Newman was trying for the first time. Being inexperienced, he never thot of scaling data which weren't there, but went ahead with what was. He never thot of using the 2-ft draft at each end to figure a barge width he didn't need. Instead, he deduced uniform displacement and uplift, with the center of buoyancy at midship. He made L the length of the barge in feet, and hence its weight in kips, and took moments about the stern after equating the buoyancy to the sum of the live and dead loads:

$$B = 24 + 40 + L$$
$$(24 \times 8) + (40 \times 48) + (L \times \tfrac{1}{2}L) = (64 + L) \times \tfrac{1}{2}L$$
$$L = 66 \text{ ft}$$
$$B = 64 + 66 = 130 = 1.97 \text{ k/ft}$$

His next step will interest those who have trouble with distributed reactions: he combined all his loads on a simple block load diagram (Fig. 1 *d*). For example, in the first 16 ft from the stern, the live load is 1.5, the dead load is 1.0, and the reaction 1.97, which is a net of 0.53 k/ft acting downward. He plotted the block above the line to look like the ordinary load set-up, but marked it negative because of its direction. Then integration of the load diagram, block by block, gave him his shear diagram (Fig. 1 *e*), on which he computed the two intercepts for zero shear. Finally he integrated the shear diagram, triangle by triangle, to obtain the moment diagram, thus:

$$-\tfrac{1}{2} \times 8.48 \times 24.75 = -105$$
$$(\tfrac{1}{2} \times 18.67 \times 23.88) - 105 = 117.9$$
$$(-\tfrac{1}{2} \times 13.58 \times 17.37) + 117.9 = 0$$

This combination of arithmetic and geometric integration is highly recommended for "exam-room technique." Numbers mean something when they are figures on figures.

Finally, the problem was a gem because one dimension was partly concealed in the draft and plotted off-scale to prevent wrong-way right answers. The test proved that prospective engineers have more trouble locating forces than in computing their effects, which prompts selection of the next gem.

EXAMGEM No. 16

A 3×12 S4S plank is suspended between two supports and used by two men removing bottom forms from a concrete slab. Each man weighs 170 lb and may carry up to 60 lb as they walk the plank, independently except that the distance between them is never less than 2.5 ft. Limiting flexural stress to 1,000 psi, determine the allowable distance between supports.

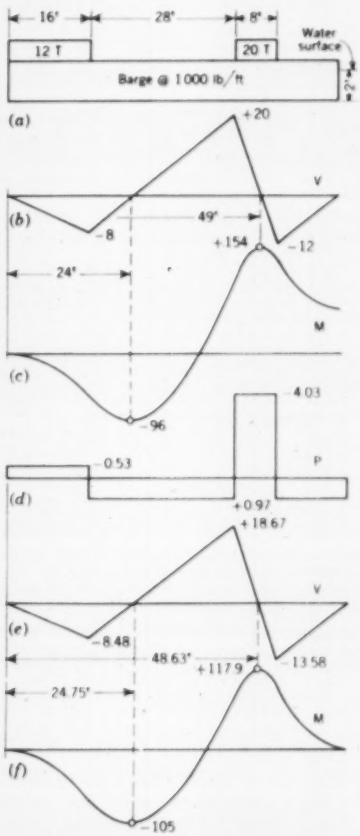


Fig. 1. (a) The barge-beam problem; (b) (c) shear and moment diagrams for a 64-ft scaled barge; (d) (e) (f) correct load, shear and moment for 66-ft barge.

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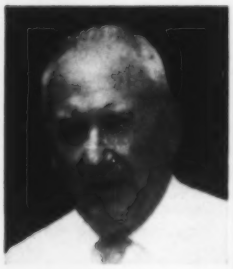

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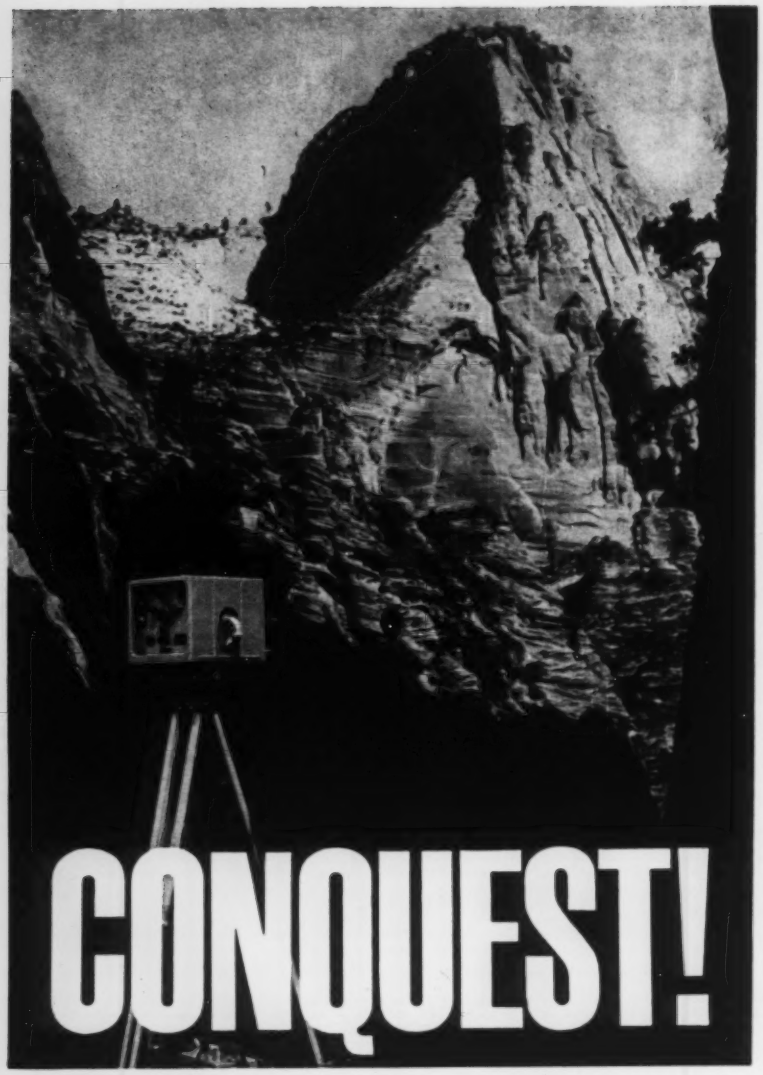

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DECEASED

L. Roy Bowen (M. '26; F. '59), age 75, former chief engineer of design and construction of municipal bridges and buildings for St. Louis, Mo., died recently in St. Louis. A city employee for 26 years, Mr. Bowen served as chief engineer from 1917 until 1933. He later formed his own firm, L. Roy Bowen & Associates. At the time of his death he was supervising architect of building at the St. Louis County Hospital.

Frank Joshua Clark (M. '26; F. '59), age 76, from 1908 until his retirement in the employ of the United States Government, died recently in Long Beach, Calif. Mr. Clark began his career in the construction office of the U. S. Military Academy, leaving in 1913 to join the U. S. Engineering Corps (now the Corps of Engineers). In 1934, he left to become civil engineer on river and harbor improvement. He returned to the Corps in 1942.

Benjamin Wilder Guppy (M. '01; F. '59), age 91, retired engineer of structures for the Boston and Maine Railroad, died recently in Melrose, Mass. Mr. Guppy was bridge engineer for the Maine Central Railroad from 1899 to 1909, leaving to become engineer of structures with the Boston and Maine Railroad. He remained there until his retirement nearly 40 years later.

Michael Halpern (M. '29; F. '59), age 67, former senior vice president and a director of Texaco, Inc., New York City, died on August 16 at Shawnee-on-Delaware, Pa. Mr. Halpern joined the firm in 1916; was named assistant manager of the refining department in New York in 1930; general manager in 1938; and head of the department in 1940. At the time of his retirement in 1957 he was director of Texaco and headed its worldwide refining interests.

George Willis Hamlin (M. '28; F. '59), age 70, former water commissioner of Cleveland, Ohio, died there on August 5. Mr. Hamlin played an important part in the construction of the city's four water treatment plants during his 45 years of service in the Cleveland Department of Public Utilities. He had been engineer of design and construction, acting commissioner of water and heat, and acting director of public utilities. He was a member of the committee that drafted the ASCE Manual of Engineering Practice on Water Treatment Plant Design. At local level he had been director and president of the Cleveland Section.

Earl W. Homan (M. '41; F. '59), age 61, prominent San Francisco civil engineer,

(Continued on page 120)

Newark's twin steel conduits still going strong after more than 60 years of service

The photograph above was taken in 1933, when construction of a highway required the relocation of a portion of Newark, New Jersey's twin Pequannock aqueducts. Those 26-mile-long steel lines were old-timers even then—and they're still going strong today!

Pequannock Number 1, 48 in. ID, went into service in 1892; its "twin" was completed in 1896. (In fact, nearly 250,000 ft of large-diameter steel pipe were put into service before the turn of the century.)

These venerable steel lines were cleaned and relined just once since they were first installed, and their carrying capacity is "as good as new." Furthermore, the City expects them to remain on the job for another thirty or forty years.

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W. & L. E. GURLEY
518 Fulton Street, Troy, N. Y.

Deceased

(Continued from page 118)

died in Belvedere, Calif., on July 17. President of the Macdonald Engineering Company from 1947 to 1959, Mr. Homan at the time of his death was a partner in the Homan and Laurence Engineering Company. An expert on river projects and grain mills, he had designed major projects in both Latin America and the United States.

Daniel Jerabek (A.M. '44; M. '59), age 57, long-time career engineer with the Corps of Engineers, died recently in Seattle, Wash. Joining the Corps in 1939, he had charge of the structural design of many projects for the Corps, including the fortification design for the Puget Sound Area. His last assignment was as chief of the structural section in the Office of the Rear Echelon of the Alaska District Corps of Engineers, with headquarters in Seattle.

John L. Keenan (M. '60), age 66, assistant chief engineer of highways with the Philadelphia Department of Streets, died there recently. Early in his career Mr. Keenan served the Department of Public Works' Bureau of Highways in several capacities, including supervisor of maintenance and general foreman, paving maintenance. In 1951 he was named principal assistant engineer, bridge maintenance, and since 1954 he had been assistant chief engineer of highways.

George F. Nicholson (M. '20; F. '59), age 76, consulting engineer of Long Beach, Calif., died there on August 25. Mr. Nicholson had been chief engineer of the Port of Los Angeles, and consulting engineer to the Port of Long Beach, the Port of Sacramento, and for several West Coast marinas. During World War II he was with the Civil Engineer Corps, U.S.N., in charge of the construction of Navy installations in San Diego and San Francisco. Mr. Nicholson was one of the joint-venture group of consultants on the recently completed $14,000,000 Los Alamitos Marina at Long Beach.

Hugh A. Powell (M. '45; F. '59); age 74, retired consulting engineer of Birmingham, Ala., died there recently. At the time of his retirement in 1954 Mr. Powell was a member of the firm of Polk, Powell and Hendon. Previously he had been associated with the Interstate Commerce Commission and the Alabama Power Company. He was a veteran of World War I, in which he served as an officer in the Corps of Engineers.

M. W. Sahlberg (M. '45; F. '59), age 68, principal structural engineer in charge of the San Francisco office of the California Division of Architecture, died recently in San Francisco. One of California's leading structural engineers Mr. Sahlberg was best known for his leadership in efforts to make California schools safe from earthquakes. He was in charge of the school house section of the Division of Architecture. Before joining the state office 15 years ago, he had been in private practice in Sacramento.

(Continued on page 124)

PUTS SCHOOLS UNDER ROOF FAST

72,237 square feet of Macomber V-LOK curved construction time on Iowa's Fort Madison High School.
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CONTRACTOR: Fane F. Vawter & Co.

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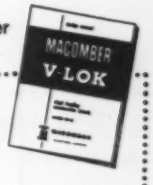

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Grundbau-Dynamik

A treatise on foundation dynamics intended both for the student in civil engineering and for the practicing or research engineer. After a general introduction, vibrating systems with concentrated masses are considered, introducing the civil engineer to the theory of forced oscillation. A chapter devoted to homogenous systems follows, and the final chapter goes into the fairly unknown area of the dynamics of soil. There is a bibliography of 115 German and English references. (By Hans Lorenz. Springer-Verlag, Berlin, Germany, 1960. 308 pp., bound. DM 46.50.)

Elementary Theoretical Fluid Mechanics

Here the fundamentals of fluid mechanics are developed with a minimum of attention to practical applications in order to provide a basis for the study of applications in many fields of advanced specialization. The author adheres to the basic equations almost exclusively to promote versatility in the fundamentals and avoid formula dependence. The text covers fluid statistics, conservation of matter and of energy, momentum, friction, dimensional analysis and potential flow. Brief treatments of acoustic velocity, cavitation, thermodynamics, and boundary layer theory are presented in appendices. (By Karl Brenkert, Jr. John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1960. 348 pp., bound. $7.50.)

Metallic Corrosion Inhibitors

A translation of a Russian monograph intended to systematize and generalize available information on the theory and practice of applying corrosion inhibitors. General theoretical problems of corrosion are not discussed. Appendixes contain information on pickling, boiler cleaning, and rust removal, and there is a useful index of inhibitors. (By I. N. Putilova and others. Pergamon Press, Inc., 122 East 55th Street, New York 22, N. Y., 1960. 196 pp., bound. $10.00.)

Structural Analysis of "Unistrut" Space-Frame Roofs

The two parts of this report cover the recommended method for computation of safe roof loads and the tables of computed factors to be used in safe load computations. The volume of text analyzes 'Unistrut' space-frame construction empirically, with a history of its development, and its general behavior on various types of supports, and outlines the general theories on which the analysis is based. The proposed method of computation is then applied to five test structures with the results of the tests, and then to a series of untested structures. The tables in Part B present computations of distribution factors, carry-over factors, and fixed-end moments. (By Paul H. Coy. The University of Michigan Press, Ann Arbor, Mich., 1959. 2 volumes, bound. $18.00.)

Structural Mechanics

This book gives critical reviews and analyses of problems of particular interest to the Navy and the Office of Naval Research in the area of naval structural mechanics. An outline of these problems and the uses of new materials form the introduction; following are papers on elasticity and plasticity in different media, shell theory, wave mechanics, fluid mechanics, instrumentation, and fracture mechanics. (Edited by J. N. Goodier and N. J. Hoff. Pergamon Press, Inc., 122 East 55th Street, New York 22, N. Y., 1960. 594 pp., bound. $8.00.)

Symposium on Effect of Water-Reducing Admixtures and Set-Retarding Admixtures on Properties of Concrete

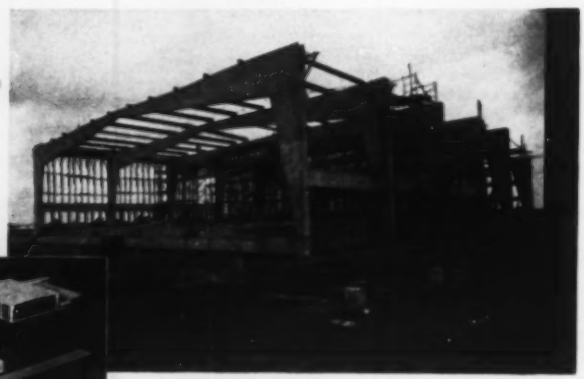
Initiated to promote understanding of concreting materials and the best manner of combining them to produce the maximum in strength and durability, this symposium consisting of ten papers and a summary, includes effects of admixtures on plastic, hardened, ready-mixed, structural and lean-mass concrete; the uses, specifications for and research objectives in admixtures; admixtures and Portland cement pastes and composition; definition of and functional differences between admixtures; testing and use of water-reducing retarders; and detection of lignosulfonate retarder in cement suspensions and paste. (Published as ASTM Special Technical Publication no. 266, by the American Society For Testing Materials, 1916 Race Street, Philadelphia, Pa., 1960. 246 pp., bound. $7.50.)

Wave Propagation in a Random Medium

In this translation from the Russian the problem of wave propagation is examined using the ray theory in part one, and the diffraction theory in part two. In the final section, the effect of the fluctuations in the incident wave on the diffraction image formed by the focusing system is examined. The results obtained are applicable to many practical problems in acoustics, optics, and radiophysics. (By Lev A. Chernov. McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36, N. Y., 1960. 168 pp., bound. $7.50.)

Another Example of Prescon's Advantages...

Savings and Long, Clear Spans Gained in School Construction



Robstown High School, Robstown, Texas
Architect and Engineers: Donnelly & Whittet, Corpus Christi

The Gym for Robstown High School has 117 ft. span (outside to outside of column) using The Prescon System to post-tension the prestressed concrete three hinged arch. Savings over conventional methods approached five figures. T. Y. Lin observed that this is one of the most outstanding structures in the country. Of the other buildings, four made use of The Prescon System in a cast in place beam and slab structural system.

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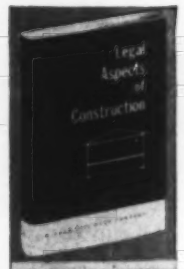

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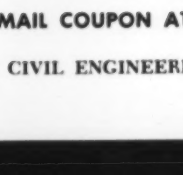

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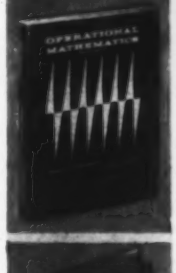

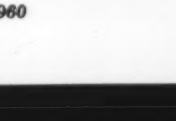

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Contractor: J. L. Coe Construction Co., Charlottesville, Virginia

PHOTO BY EZRA STOLLER

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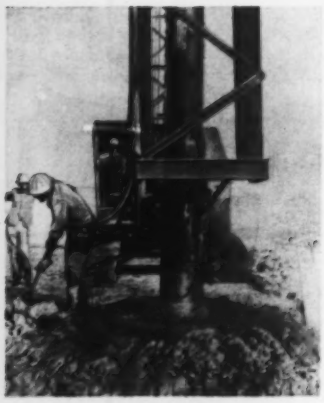
The foundations for the new Sarasota Senior High School, Sarasota, Florida, were built on sand compacted by Vibroflotation. 260 compactions were made to an average depth of 13 feet.



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Deceased

(Continued from page 120)

Ola T. Sater (M. '44; F. '59), age 66, retired civil engineer of Gibbs and Hill, Inc., engineering and construction firm of New York and Los Angeles, died in Pompton Plains, N. J., on September 5. Prior to his retirement in 1959, Mr. Sater was a supervising engineer with Gibbs & Hill, during most of his career. Projects for which he supervised the structural design included El Centro Steam Electric Generating Station of the Imperial Irrigation District, El Centro, Calif., and power plants of the Indianapolis Power & Light Company, and City Public Service Board of San Antonio, Tex. He also had worked with the New York City Board of Water Supply on the Delaware Aqueduct project, and with other engineering organizations.

Ralph W. Stewart (M. '22; F. '59), age 82, at one time chief deputy city engineer of Los Angeles, died in that city recently. He joined the Los Angeles City Engineer's Office in 1909 and remained there until his retirement 38 years later. He was head of the Bridge and Structural Design Division for 26 years, and chief deputy city engineer for ten years. Mr. Stewart was the author of numerous Transactions papers. His publications included a treatise on stress analysis, which described a method he had developed.

Hans Toensfeldt (M. '30; F. '59), age 80, an engineer for New York City from 1934 to 1942, specializing in school construction, died in New Lebanon, N. Y., on August 14. His early career included ten years as an engineer for the Department of Education in St. Louis. From 1942 until his retirement five years ago Mr. Toensfeldt was a consulting engineer at the Naval Training Station at Bainbridge, Md.

Roy E. Ward (M. '44; F. '59), age 74, since 1945 vice president and district manager of the Austin Company at Los Angeles, Calif., died there recently. A member of the Austin staff for more than 25 years, Mr. Ward had served the firm as design engineer, sales engineer, district manager and assistant general manager. Earlier he had been design engineer for the Aluminum Company of America.

Joseph L. Wehmeyer (M. '43; F. '59), age 66, for 40 years traffic and safety engineer with the Wayne County (Michigan) Road Commission, died in Detroit on August 1. He was a 1916 graduate of the University of Michigan, and served as a first lieutenant in the Corps of Engineers, 1917 to 1919. He then became a staff-member of the Road Commission, where he remained until his retirement last January.

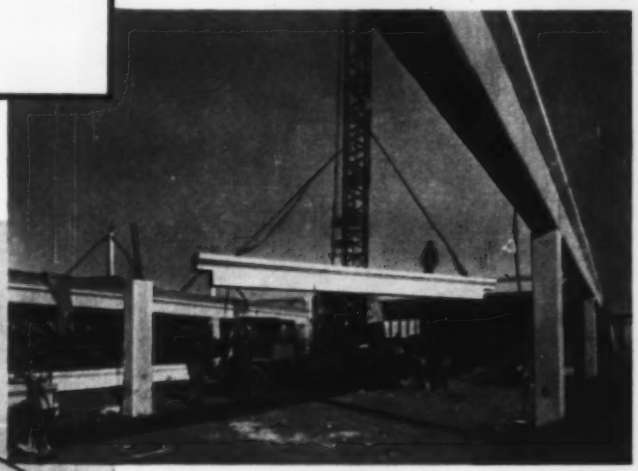
Evan Taylor Wilson (M. '20; F. '59), age 80, retired senior designer in the engineering department of the Bethlehem Steel Corporation, died in Allentown, Pa., recently. Prior to joining Bethlehem Steel in 1936, Mr. Wilson had

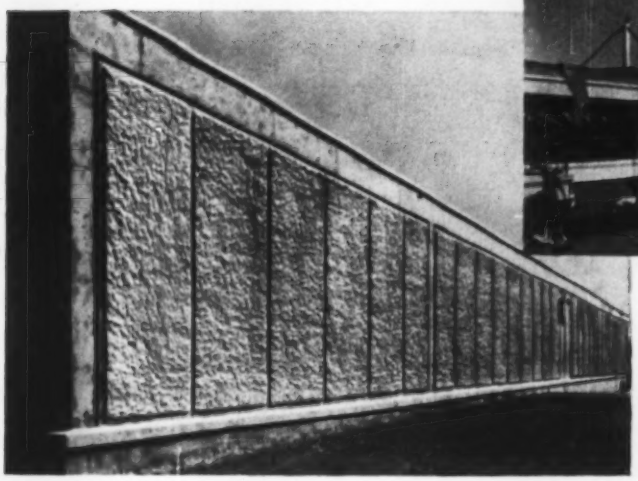
(Continued on page 126)

Prestressed members, textured tilt-up walls

FOR NEW ALL-CONCRETE CANDY FACTORY

Owner: Pearson Candy Company, St. Paul, Minn.
Architect: Thorshov & Cerny, Inc., Minneapolis, Minn.
Contractor: C. O. Field Co., Minneapolis, Minn.
Prestressed Units: Prestressed Concrete, Inc., Roseville, Minn.
Ready Mix Concrete For Tilt-up Slabs: Guaranteed Concrete Company, St. Paul, Minn.
Light Weight Concrete Decking: Western Mineral Products Co., Minneapolis, Minn.





(*Above*) The 160′ x 390′ building is framed on 30′ x 30′ and 39′ x 30′ column centers. Beams are prestressed, columns precast. The floor area at the two story kitchen supports live load of 225 lbs. per sq. ft. without reduction in column spacing.

(*Left*) Most striking outward feature of the new Pearson factory is the tilt-up concrete wall. The interesting texture was achieved by casting the slabs on beds of gravel which had first been covered with plastic film. A total of 47 slabs 12′ high and of lengths from 5′ to 39′ was required.

• Prestressed beams, channels, and precast columns provide the structural strength and large open floor areas needed for the Pearson Candy Company operation at St. Paul, Minn. Lightweight concrete roof decking and interesting tilt-up walls provide insulation and architectural effect, and complete the fireproof and low maintenance qualities of the building from roof to foundation.

Lehigh Cements were used throughout. Lehigh Portland for tilt-up walls. Lehigh Early Strength for precast and prestressed members, and for the roof decking. Lehigh Portland Cement Company, Allentown, Pa.

LEHIGH CEMENTS

504 prestressed channel slabs, each spanning 30′, were used in the roof. Over these, lightweight concrete decking was used tc insulate and reduce dead load. The simplicity of design seen in this picture indicates the ease with which an efficient building can be erected, using modern concrete construction methods.

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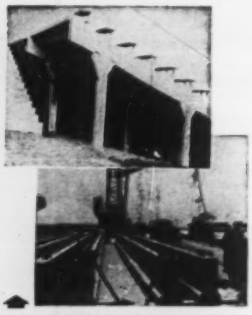

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Deceased

(Continued from page 124)

been chief engineer of the Vander Stricken-Ewing Consulting Company, Bethlehem, Pa.; design engineer with the Bethlehem Construction Company, (successors to Vander Stricken-Ewing); and consulting civil and structural engineer in Bethlehem.

Richard H. Wilson (M. '55; F. '59), age 72, former California assistant state highway engineer in charge of administration, Sacramento, Calif., died there on August 14. At the time of his retirement in 1957 Mr. Wilson had served the State Highway Division in various capacities for 35 years, for the last ten as assistant state highway engineer. He was responsible for much of the highway construction in the virgin redwood region of Humboldt County. He was a World War I veteran, having served with the 20th Engineers. Mr. Wilson was active for many years on the ASCE Highway Division's Committee on Developments in Highway Engineering and Construction.

Positions Announced

Department of Health, Education, and Welfare. Competitive examinations for appointment of Sanitary Engineers as officers in the Regular Corps of the Public Health Service will be held January 31 through February 2, 1961, for Junior Assistant applicants and January 31 through February 3, 1961, for Assistant and Senior Assistant applicants. Application forms are obtainable from the Surgeon General, U. S. Public Health Service (P), Washington 25, D. C., or from field stations of the PHS. The completed forms should be in the office of the Surgeon General no later than December 2, 1960.

United States Department of the Interior. Openings exist for graduate engineers with professional or teaching experience in the fields of stress analysis, materials, structures, or general civil engineering interested in research in rock mechanics (starting salarly up to $10,895) at the U. S. Bureau of Mines experiment station at College Park, Md. Applicants should mail resume or Standard Form 57 to Applied Physics Research Laboratory, U. S. Bureau of Mines, College Park, Md.

U. S. Army Corps of Engineers. Applications are being accepted for the posts of Construction Engineer, GS-12 ($8,955); Construction Engineer, GS-11 ($7,560); 2 Construction Engineers, GS-9 ($6,435); 2 Construction Representatives, GS-9 ($6,435); and 2 Civil Engineering Aids, GS-7 ($5,355). These positions exist at the Area Field Office, Plattsburgh Air Force Base, N. Y. Interested applicants should contact the Area Engineer, U. S. Army Engineer District, New York, Plattsburgh Area Field Office, P. O. Box 161, Plattsburgh, N. Y.

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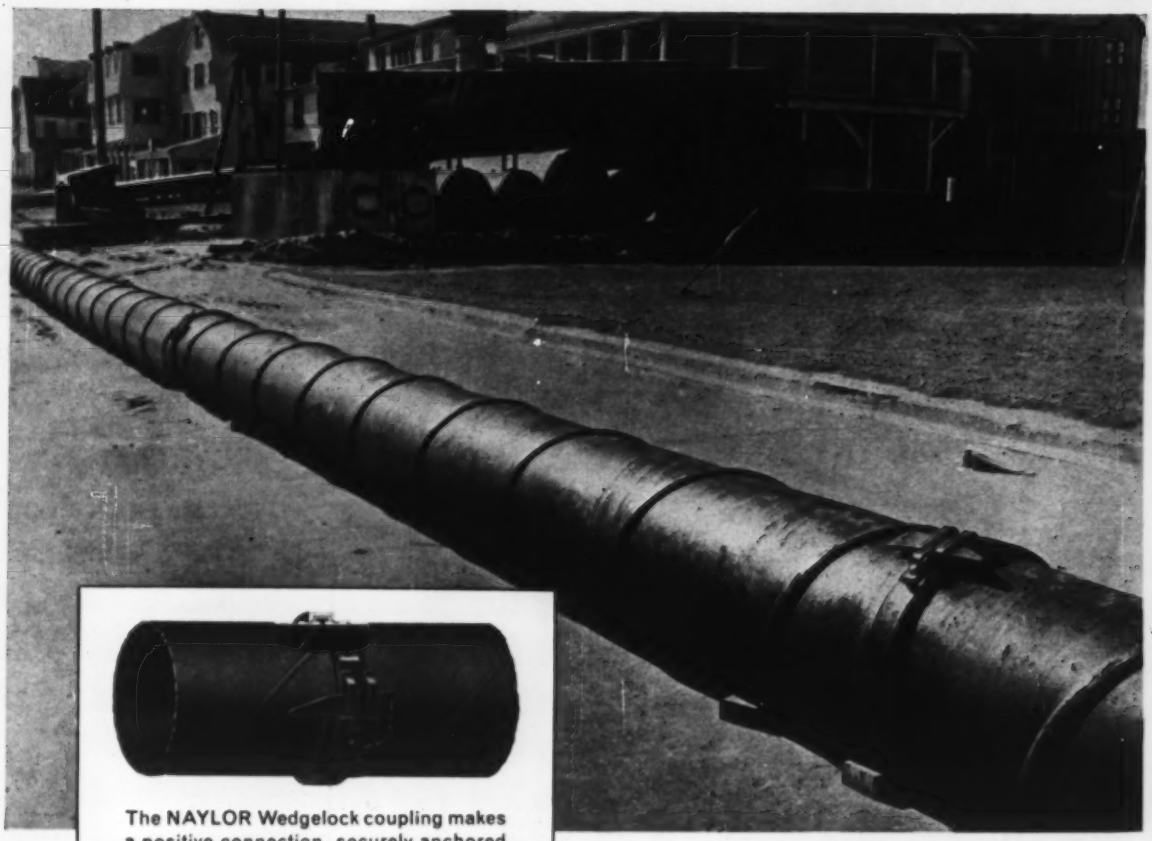

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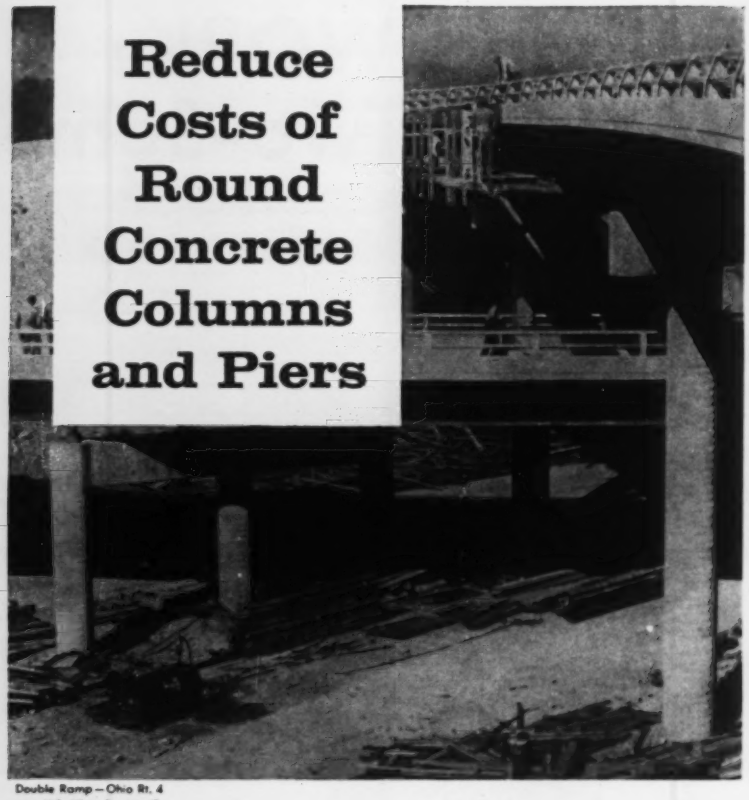

Double Ramp—Ohio Rt. 4 over U.S. 25 at Dayton, O. Contractor: Maxon Construction Co., Dayton. Engineer: Howard Needles Tammen & Bergendoff, Kansas City, Mo.

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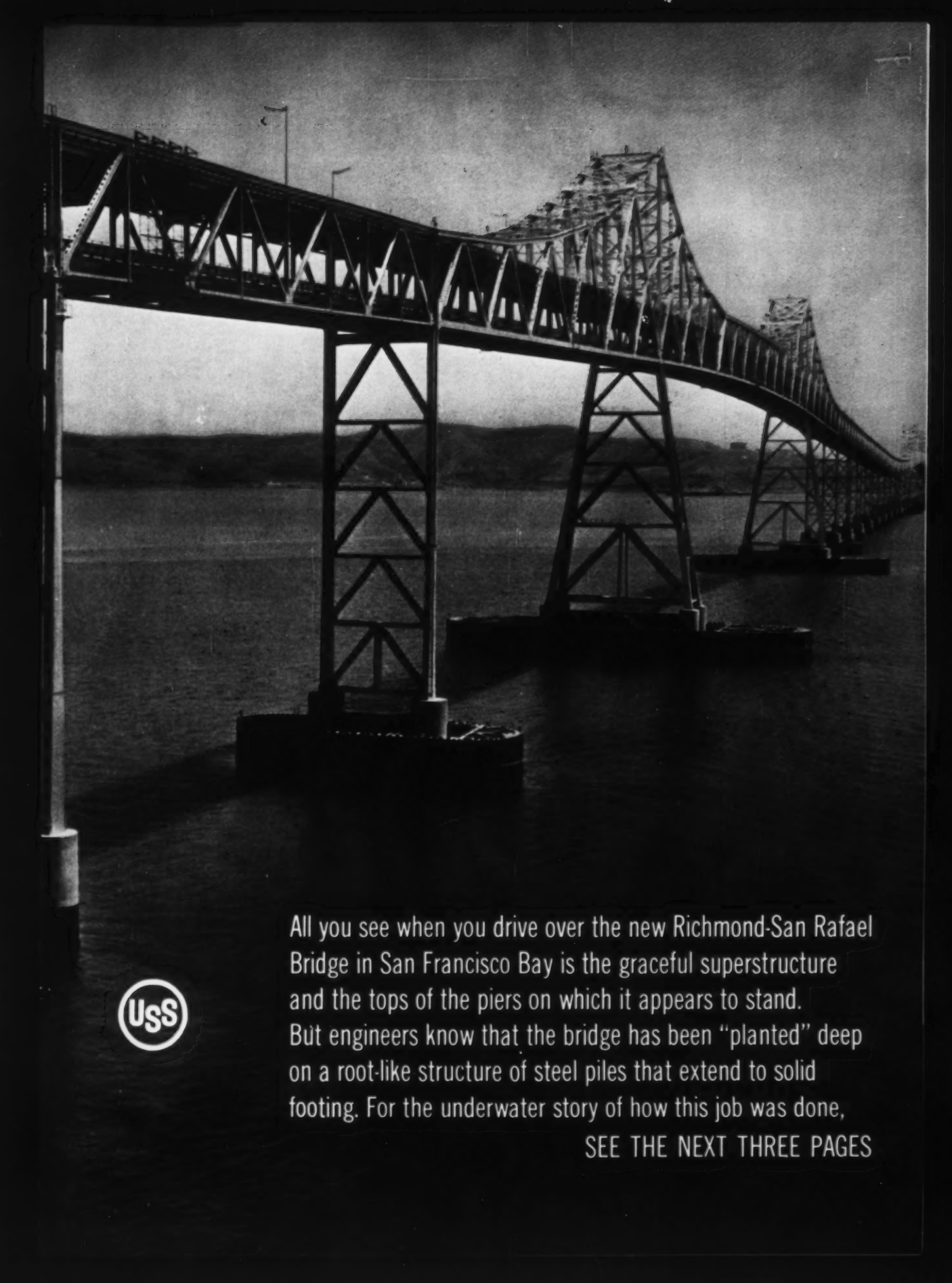
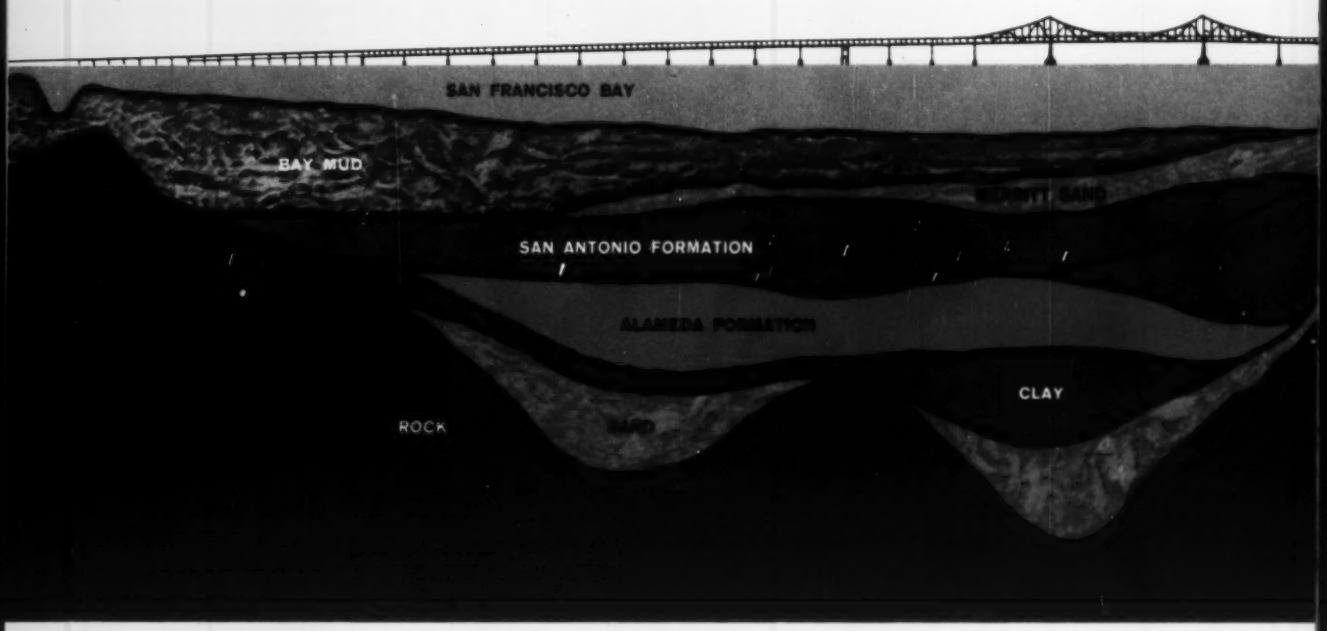
(Continued on page 134)



All you see when you drive over the new Richmond-San Rafael Bridge in San Francisco Bay is the graceful superstructure and the tops of the piers on which it appears to stand. But engineers know that the bridge has been "planted" deep on a root-like structure of steel piles that extend to solid footing. For the underwater story of how this job was done,

SEE THE NEXT THREE PAGES

Richmond-San Rafael Bridge over San Francisco Bay—length 21,345 feet. Lower sketch shows stratification encountered and points up need for extra long piles. This bridge was built for the State of California, Department of Public Works, Division of San Francisco Bay Toll Crossings. Substructure General Contractor: Ben C. Gerwick, Inc., and Peter Kiewit Sons Company.



Problem: How to put the Richmond-Solution: USS H-Piles under novel

The Richmond-San Rafael Bridge, just north of San Francisco, is one of the world's longest. It stretches across the bay for 21,345 feet. This makes it longer than the Mackinac Bridge and only 1,377 feet shorter than the San Francisco-Oakland Bay Bridge. The new bridge has two decks, each carrying three lanes of traffic across San Francisco Bay between Richmond and San Rafael, California.

Tests on soil samples indicated proposed loads on displacement-type piles would probably result in excessive settlement. It was decided that piles had to be driven to rock or into a deep sand-gravel stratum.

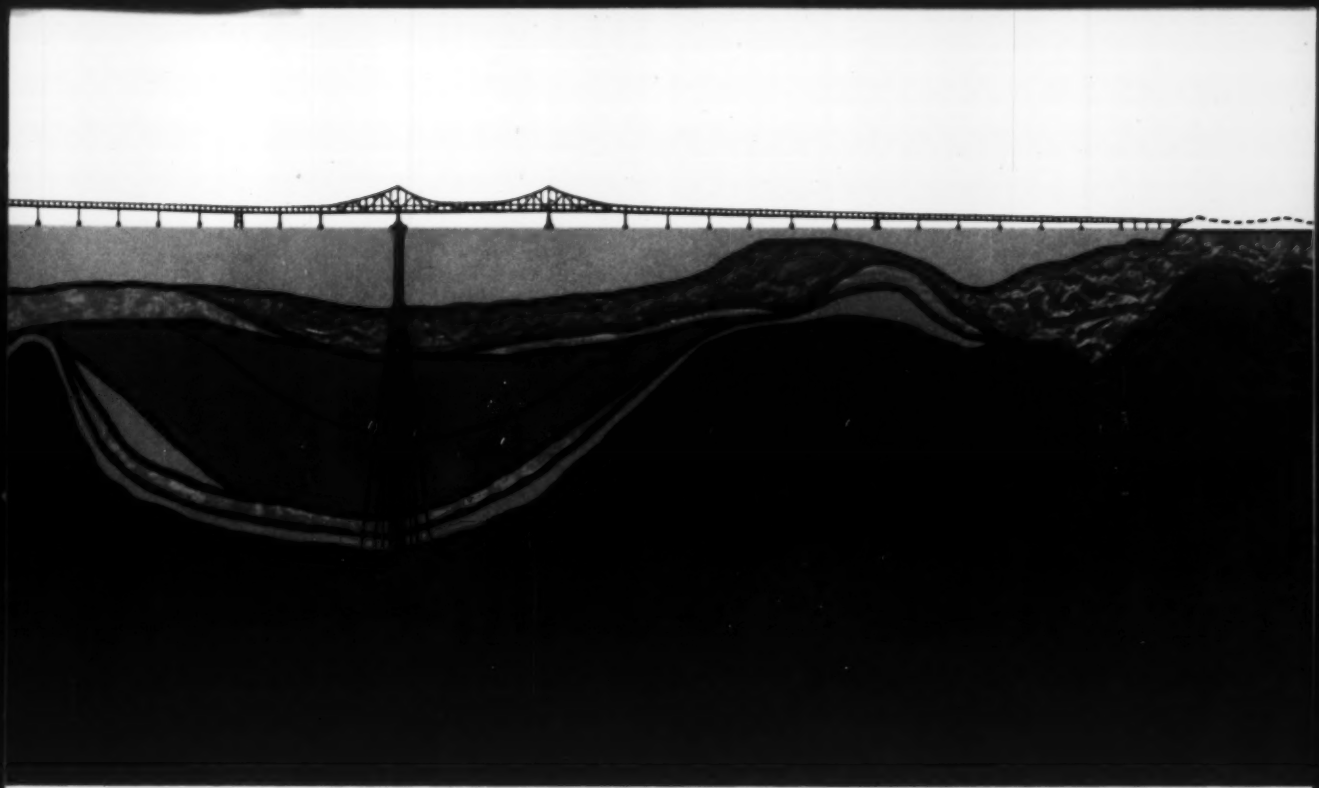
Studies indicated that steel H-piles were the logical choice because:

1. H-piles were more suitable for penetrating the deep overburden in order to reach suitable strata for end bearing.
2. H-piles provided utmost flexibility of final lengths—they could be easily cut or spliced.
3. Their ruggedness made for easy handling.
4. Their strength permitted heavy loads per pile.
5. They were readily available.

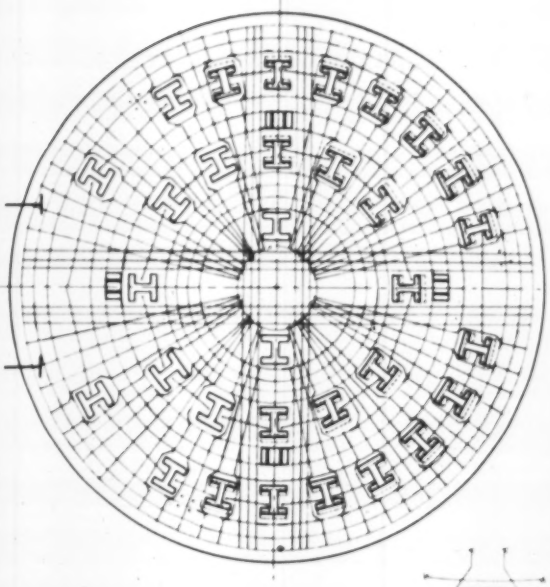
Precast bell-type piers were selected for the deep water portion of the job. These had proved economical for pile-supported piers in moderately deep water on previous major bridge jobs. At each bell-pier location, several steel H-piles were driven to position a precast concrete base grid which was later incorporated in the pier foundation. The base grid contained slots designed to act as guides for the remaining 14-inch, 89-pound steel H-piles. These were later grouted into the base grid which then served as the base for the precast bell sections set on top. After pouring a tremie seal inside the bells, the rest of the concrete was placed in the dry. These base grids were 12 to 56 feet below water so that the contractor had to provide for underwater driving of piles. This was done with rigs especially designed for the job to provide telescoping leads to support the hammer as deep as 56 feet under water and the pile head as much as 110 feet above the water.

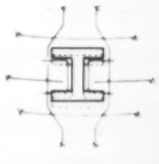
There were 62 bell-type piers constructed. In addition, 8 cofferdam-type piers and 9 dry-land piers also utilized steel H-piles. The 79 piers are supported by 5,047 14-inch, 89-pound steel H-piles ranging in length from 30 to 175 feet—a total of 585,700 lineal feet, or about 25,000 tons, approximately half of which were supplied by United States Steel.

For information on any type of steel piling—steel H-piles, sheet piling or steel pipe piling, write to any of our district offices or United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

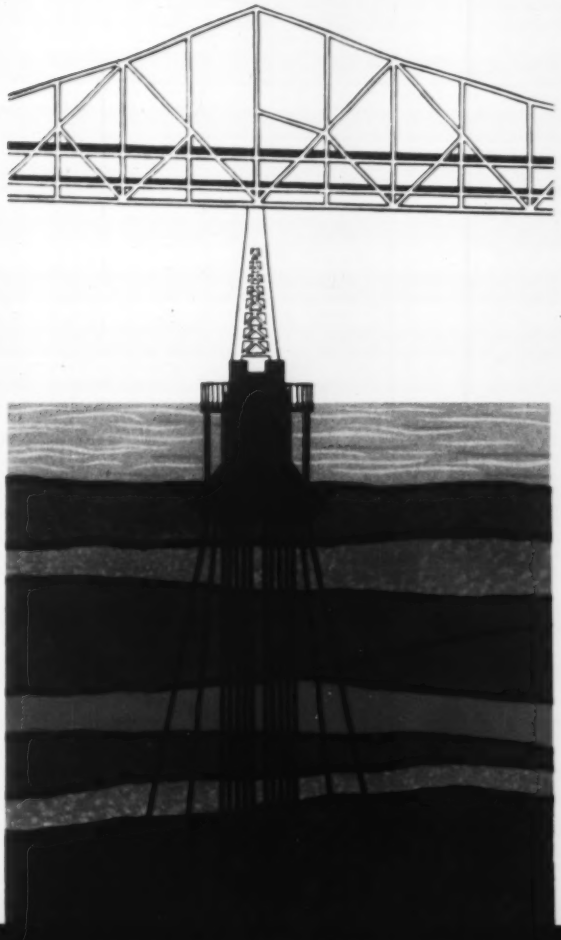


San Rafael Bridge across these holes... bell-type piers





Base grid for bell-type pier showing slots for locating piling. Batter piles indicated by dotted lines and shown in detail on small drawing.



TURN PAGE

how the bell-type piers were constructed underwater

1. At each pier location, concrete base grids containing slots to guide the steel H-piles were lowered through the water to exact position. Some were as deep as 56 feet.

2. Several steel H-piles were driven to hold each base grid in exact position. The remaining piles were then driven and the base grids were later incorporated in the pier foundation. Where necessary, pile tops were cut off underwater by divers.

3. Cylindrical precast bell sections were lowered through the water and positioned on top of each base grid. A special seal made the joints watertight.

4. Cone-shaped precast concrete or steel sections with a seal on top and bottom were then placed on top of the cylindrical sections.

5. Precast shaft extending above water. After pouring a tremie concrete seal inside the bells, the rest of the concrete was placed in the dry.

For the main piers using four interconnected bells and for some of the two-bell piers, special steel forms were used instead of precast concrete bells.

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By Richard H. Clough, *University of New Mexico.* Covers the five basic management functions—organizing, staffing, directing, planning, and controlling—as they are applied to the construction contracting field. *1960. 382 pages. $9.75.*

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THE NATURE AND PROPERTIES OF ENGINEERING MATERIALS

By Z. D. Jastrzebski, *Lafayette College.* Much more basic than the usual treatment, this book stresses materials from the engineering viewpoint, with realistic and practical applications. *1959. 576 pages. $11.00.*

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Non-ASCE Meetings

American Institute of Steel Construction. Thirty-eighth annual convention at the Hotel Greenbrier, White Sulphur Springs, W. Va., October 30-November 3.

American Public Health Association. Eighty-eighth annual meeting at the Civic Auditorium, the Sheraton-Palace Hotel, the Whitcomb Hotel, and the Jack Tar Hotel, San Francisco, Calif., October 31-November 4.

American Society of Mechanical Engineers. Annual winter meeting at the Statler Hilton Hotel, New York, N. Y., November 27-December 2. In conjunction with the annual meeting ASME will sponsor the twenty-fourth National Exposition of Power and Mechanical Engineering at the New York Coliseum, November 28-December 2.

Building Research Institute. Annual fall conference on the use of preassembled large building components at the Shoreham Hotel, Washington, D. C., November 15-17.

Consulting Engineers Council. Semi-annual meeting at the Penn-Sheraton Hotel, Pittsburgh, Pa., November 10-12.

FIP-RILEM. Symposium on injection grout for prestressed concrete at Norges Tekniske Hogskole, Trondheim, Norway, January 5-7, 1961. For further information contact Professor I. Lyse, NTH, Trondheim, Norway.

Inter-American Congress of the Construction Industry. Second meeting of the Congress is being organized by the National Chamber of the Construction Industry of Mexico and will be held in Mexico City, Mexico, October 31-November 6. Information from Gonzalo Gout, President, Second Inter-American Congress of the Construction Industry, Florencia 37, Mexico 6, D.F.

Pacific Northwest Pollution Control Association (formerly the Pacific Northwest Sewage and Industrial Wastes Association). Annual meeting at the Mareus Whitman Hotel, Walla Walla, Wash., October 20-22. Write to G. H. Dunstan, Secretary-Treasurer, Box 178, Pullman, Wash.

Structural Clay Products Institute. Annual convention at the Diplomat Hotel, Hollywood, Fla., November 14-16. Requests for additional information should be directed to J. J. Cermack, Director of the Convention and SCPI Secretary, 1520 18th Street, N.W., Washington 6, D. C.

University of California. Two western conferences on prestressed concrete buildings presented by the University at the Biltmore Hotel, Los Angeles, November 14-15, and at the Sheraton Palace Hotel, San Francisco, November 21-22.

Applications

(Continued from page 128)

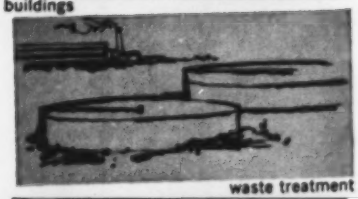
GLEN ALAN HULTQUIST, Milwaukee, Wis.
SAIYID AHMAD IKRAMULLAH, Kansas City, Kans.
FOUAD BISHARA KARDOUSH, Ames, Iowa
ERWIN WALTER KENT, Briarcliff, N. Y.
GEORGE FRED LEE, Pittsburgh, Pa.
KENNETH LEVINE, New York, N. Y.
MOHAMMED ABDUL MAJEED, Charlottesville, Va.
BERNARD LEONARD METTERS, Columbia, Mo.
JAMES RICHARD NEWKIRK, JR., Jackson, Miss.
MIAN ABDUL RASHID, Karachi, Pakistan
ROBERT LEE ROBBINS, Canal Zone, Panama
BERNARD LOUIS RUCKSTUHL, New Orleans, La.
PRABODHCHANDRA GIRIJASHANKA SHUKLA, Los Angeles, Calif.
JUNG HYUN SUH, Washington, D. C.
MICHAEL DANIEL TKACHUK, Alberta, Canada
BENJAMIN HING-YIM TU, Troy, N. Y.
JONES EVANS TYSINGER, Knoxville, Tenn.
JON CONRAD VANDEN BOSCH, Princeton, N. J.
JACK CARVER WILLIAMS, Palo Alto, Calif.
WILLIAM FONDREN WILLIS, Wilson Dam, Ala.
SIU-LEUNG WONG, Hong Kong
ASIM YEGINOBALI, Columbus, Ohio
WEI-WEN YU, New York, N. Y.
MUHAMMAD FARUK ZEIN, Syria, United Arab Republic

[Applications for the grade of Associate Membership from ASCE Student Chapter Members are not listed.]

highways

rivers & harbors

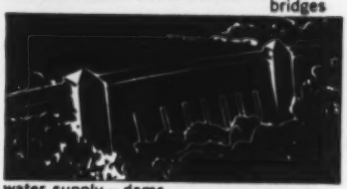
buildings



waste treatment

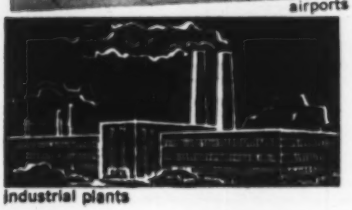
pipelines

bridges



water supply — dams

airports



industrial plants

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Buildings, commercial & residential	17.9	Rivers & harbors	1.6
Dams	2.7	Waste treatment	10.9
Highways & streets	14.6	Water supply	10.1
Industrial plants	9.1	Miscellaneous	13.2

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CONSTRUCTION MANAGER OR SUPERINTENDENT, M. ASCE, 4 years' C.E. Thirty-three years' in the design and construction of buildings such as housing, industrial shops, utilities, streets and roads, airports, pipe lines and pumping stations and refinery, including 15 years' in South America. Fluent Spanish. Salary, $15,000 a year. Location desired. Foreign, Eastern U. S. C-601.

OPERATIONS CONSULTANT, A.M. ASCE, M.S.C.E. (Sanitary Major), 30. Experienced in making investigations of municipal water and sewage treatment facilities and performing control tests to determine effectiveness of treatment process. Also, some design and field experience on small water and sewage treatment projects. Salary, $8,400 a year. Location desired, Northeast or Northwest. C-602.

CONSTRUCTION ENGINEER, M. ASCE, B.S. in C.E., registered, 33. Seeking job with general contractor doing or leading to estimating and administrative work. Experienced in supervision of construction of highways and bridges. C-603.

This is only a sampling of the jobs available through the ESPS. A weekly bulletin of engineering positions open is available at a subscription rate of $4.50 per quarter or $14 per annum, payable in advance.

CIVIL ENGINEER, A.M. ASCE, B.S.C.E., M.E. ADM, M. NSPE, P.E. Nine years' experience in diversified aspects of master planning, design, specifications and construction of light commercial buildings and industrial structures, utility systems and highways in research facilities and commercial developments. Capable as project manager. Knowledge of Spanish and German. Location desired, Foreign. C-604.

PROJECT ENGINEER, ESTIMATOR, A.M. ASCE, S.M., B.S.C.E. Resident engineer on sanitary projects for 1 year; in structural research for 2 years, estimating projects in heavy construction for 1 year. Salary, $10,200 a year. Location desired, Northeastern U. S. C-605.

CIVIL ENGINEER, A.M. ASCE, BSCE, Registered P.E., 32. Ten years' broad structural experience; 4 years' designing and supervising construction of storm power plants, 1 year supervising construction of schools, 3 years' designing bridges. Salary, $9,000 a year. Location desired, East. C-606.

CHIEF ENGINEER OR MANAGEMENT, M. ASCE, B.S.C.E., 37. Three years' engineering management experience for consultant, and 7 years' structural design experience. Desire responsible and challenging position. Available immediately. Location desired, Chicago. C-1157-Chicago.

CONSTRUCTION ENGINEER, A.M. ASCE, B.S.C.E., 30. Two years' experience in design and supervision of general construction; site development of subdivision, buildings, etc.; 3½ years' in highway construction, including 2½ years' as project engineer in complete charge of over million dollar constructions. Salary, $7,500 a year, plus. C-1158-Chicago.

CIVIL ENGINEER, A.M. ASCE, B.S.C.E. Professional Engineer License, 35. Twelve years' supervisory experience; 11 years' railroad maintenance and construction experience and 1 year's highway and bridge construction experience. Salary $9,600 a year. Location desired, Midwest, Southwest. C-1159-Chicago.

FIELD ENGINEER, A.M. ASCE, B.S. and M.S.C.E. registered E.I.T., 29. One year spent on highway location and construction surveys, and 3 years as assistant soils engineer including all phases of preparation and execution of test boring work. Military service completed. Location desired, Midwest. C-1160-Chicago.

FIELD OR MUNICIPAL ENGINEER, A.M. ASCE, B.S.C.E., licensed Ohio and Pa., surveyor Ohio, 30. Two years' experience on building inspection, commercial. Field Engineer oil industry inspection, design, construction; private practice in small structure design, plan checking on larger projects. Salary, $9,000 a year. Location desired, Midwest or South. C-1161-Chicago.

STRUCTURAL DESIGNER, M. ASCE, MS C.E., 37. Experience includes structural design, irrigation projects, prefab steel buildings, cranes, bridges, and teaching. Also 1 year on the research of structures under action of earthquake for consultant. Salary, $9,000 a year. Location desired, San Francisco Bay Area. Se-1731.

SUPERINTENDENT, ESTIMATOR, A.M. ASCE, MS C.E., 25. Three years' diversified heavy construction experience connected with highway, levee, and canal projects in both estimating and construction phases. Speaks Spanish. Salary, $9,000 a year. Location desired, West, Northwest, Foreign. Se-1646.

PROJECT ENGINEER, M. ASCE, C.E., 45. Twenty-four years' broad domestic and foreign experience. Desires foreign assignment as project engineer in general construction in Latin American or Pacific area. Immediately available. Location desired, Latin America. Se-1642.

ASSOCIATE OR PARTNER, F. ASCE, C.E. Registered Civil Engineer, 57. Thirty years' broad experience in the supervision of planning, and the design and construction of missile bases, airfields, industrial buildings, housing and utilities systems as well as municipal work. Interested in association or partnership with active consulting firm in the Southwest. Salary, $12,000-$15,000 a year. Location desired, Southwest. Se-1581.

DESIGN—FIELD ENGINEER, F. ASCE, ArchE, 52. Thirty years' experience in supervision of design and field construction and contract management of dams, waterfront structures, airfields, industrial building, school buildings and miscellaneous construction. Salary, about $10,000 a year. Location desired, West U. S. or East Coast. Se-1568.

GRADUATE ENGINEER, with professional experience in the fields of photogrammetric mapping, and civil and/or mechanical engineering to work in analytical photogrammetric equipment development at the U. S. Army Engineer Geodesy, Intelligence and Mapping Research and Development Agency, Fort Belvoir, Virginia (Located 15 miles south of Washington, D. C.). Applicants must be U. S. citizens and meet full U. S. Civil Service qualification requirements.

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PROJECT MANAGER, F. ASCE, C.E. Regis ME, Calif., 59. Many years in charge of hydroelectric projects, domestic and foreign. Salary, $15,000 a year. Location desired, Foreign. Se-1508.

DESIGN—CONTRACT ADMINISTRATOR, M. ASCE, C.E., LLB, 42. Twenty years' experience including specifications, contract documents, construction contracts, design, specifications, supervise construction, office and field on general building, airport facilities, railroad, oil production. Salary, $10,200 a year. Location desired, San Francisco Bay Area, West Coast. SE-1424.

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ENGINEERS. (a) Design engineer, graduate civil, with a minimum of 10 years' progressive experience in structural design, preferably of large unique and novel structures, including radar antennas. Salary, $12,000 a year, plus. (b) Field engineer (plant and field supervision and inspection), with experience in the detailed design of large antennas, fabrication and field erection. Salary, $8,000 a year. Location, South. W-9532.

PROFESSOR OR ASSOCIATE PROFESSOR with at least a M.S. in civil engineering and teaching experience in the field of structures. Location, East. W-9530.

MATERIALS ENGINEER, civil graduate, P.E. license, with experience covering control of soils, concrete or asphalt plus some knowledge of construction. Salary, $8,000-$10,000 a year. Location, Eastern States. W-9523.

CHIEF ENGINEER, civil, with at least 20 years' experience including some design and administration and much field supervision of heavy construction plus highway work. Salary open. Location, South. W-9517.

ENGINEER, R & D, graduate civil or mechanical, 25-40, for work which will include technical writing, consultation, research and development relating to the curing of concrete products with steam at high pressure. Permanent position. Submit complete resume including salary desired. Employer will negotiate fee. Location, East. W-9496.

WATER SUPPLY FIELD ENGINEER, with 5 years' general experience, married without children, for surveys of municipal water distribution systems. Permanent position with frequent location changes. Salary open; profit sharing. Headquarters, New York City. W-9483.

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CIVIL ENGINEERS. (a) Project architect-engineer, civil engineer or architect, for supervision of project design and staff architect duties, with 10 to 20 years' experience including 5 years' design supervision with an architectural or consulting engineering firm covering industrial and commercial buildings. Some traveling. Salary, about $13,000 a year. (b) Resident engineer, civil engineer or building construction graduate, 29-35, for responsible charge of construction projects, with 6 years' experience including 3 years' in the field supervising industrial and commercial building construction. Salary, to $11,000 a year plus reasonable expense allowance for field assignments. Headquarters, upstate New York. W-9472.

ASSISTANT PUBLIC WORKS DIRECTOR, B.S. in engineering, preferably in civil or municipal, with extensive public works experience, some of which should have been in a responsible position. Knowledge of, and familiarity with, the problems of municipal sanitation and drainage, street and subdivision design, building, plumbing and electrical inspection, and fire inspection and prevention. Will assist in planning and administering the construction, maintenance and general management of the physical properties and certain utility services. Salary, $9,000-$11,280 a year. Location, South. W-9464.

WATER MANAGER, graduate engineer, with at least 3 years' experience including a year in utility management, for a city of 12,000. Appropriate experience may be acceptable in lieu of degree. Water system includes wells, pumping stations, tanks and distribution mains. Salary commensurate with ability and experience, to $7,200 a year maximum plus benefits. Employer pays placement fee. Location, East Coast. W-9469.

PROMOTIONAL ENGINEER, graduate C.E., 27-40. As assistant to managing director of trade association will prepare technical articles and reports, attend technical meetings, discuss problems with manufacturers and promote use of concrete pipe. Good sales personality; considerable travel by air, but home most weekends. Employer will pay placement fee. Salary, $7,000-$10,000 a year, depending on experience. Location, Chicago. C-8238.

FIELD SUPERVISOR, C.E. background, 27-35. Some construction experience and interest in site supervision work. Will be brought into plant, trained for year or so and then assist in subsequent superintendency of installation and erection of metal work on buildings for manufacturer and subcontractor. Will be required to join Iron Workers Union as a finisher. Western States travel involved. Headquarters, San Francisco East Bay. Salary, $6,000 during training period; to $7,800-$10,200 after one year. Sj-5547.

CHIEF DRAFTSMAN, minimum of 10 years' experience in structural steel and miscellaneous steel detailing. To take charge of drafting department. Starting salary $8,400-$9,600. Apply by resume. Location, Central California. Sj-5532.

SOILS MECHANICS ENGINEER, C.E., experience in both field and office engineering for consulting firm with offices throughout the country. U.S. citizenship required. Salary to $8,000, depending on qualifications and experience. Location, West Coast. Sj-5534.

JOB ENGINEER, engineering background and at least 5 years' experience on all phases of construction; highways, underground, general engineering buildings, heavy concrete structures, dams. To work in field, take charge of construction for a contractor. Salary about $7,800 a year. Headquarters, Northern California. Sj-5504.

RESIDENT ENGINEER. Prefer C.E. will consider ME or EE with construction of building structures experience with minimum of 6 years' engineering and construction experience, including at least 3 years' in field supervision construction of manufacturing plans. Experience on engineering design work such as computations drawings, estimate and specifications desirable. Job responsibility would include full responsibility for supervision of contractors' work in construction of sizeable project in million dollar range or above. Salary to $10,000 depending on qualifications and experience. Location East Coast. Sj-5503.

CITY ENGINEER, DIRECTOR OF PUBLIC WORKS, Registration in Nevada, or qualified for registration. Should have a strong background in municipal engineering, particularly planning and subdivision work and be able to handle building inspection services for former "government town", recently incorporated. All land owned by municipality and being subdivided and sold or will be sold as raw land to be subdivided by the buyer. Starting salary $7,600-$8,400 a year. Good potential. Location, Nevada. Sj-5521.

ESTIMATOR, prefer at least 5 years' experience in heavy general building construction, commercial, government and military installations. For bid purposes, take off and pricing. Salary, about $7,800. Northern California. Sj-5505.

DESIGNER, C.E., California Registration, any age. Minimum 3 to 5 years' recent experience working on sanitary and sewer projects for a sanitation district. Salary, $7,728-$9,384 a year. Location, San Francisco North Bay Area. Sj-5474.

FIELD ENGINEER, C.E., under 45. Minimum three years' experience in field supervision, field office work, including design and application; some preference for well developed structural experience for a small group in a large transportation company. Salary $6,300-7,500 a year. Location, San Francisco Sj-5467.

CHIEF ARCHITECT, ARcht or C.E., 35-45. Mature, well seasoned architect, able to handle a complete department from client development through negotiation to field supervision, preferably experienced in schools and multi-story work, including public, commercial and industrial buildings. For an established consulting engineering firm with departments in all fields. Salary, $9,600-12,000 a year. Location, San Francisco East Bay. Sj-5464.

ARCHITECTURAL DESIGNER, minimum 5 years' experience in heavy industrial or commercial architectural drafting and with some experience in refineries or chemical plants desirable. Or recent graduate with some industrial experience desiring to train under Registered Professional Architect. U.S. citizen preferred. Salary, $6,600-$8,400 a year, depending on experience. Location, Southern California. Sj-5454.

GEOLOGIST, Registered C.E. with knowledge of concrete, soil mechanics, geophysics and groundwater hydrology and ability to manage laboratory operations. Location, Southwest California. Sj-5396.

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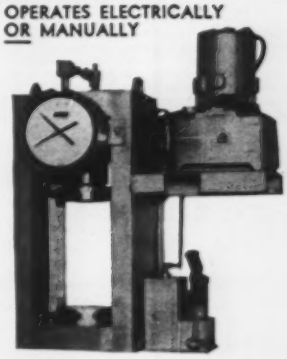

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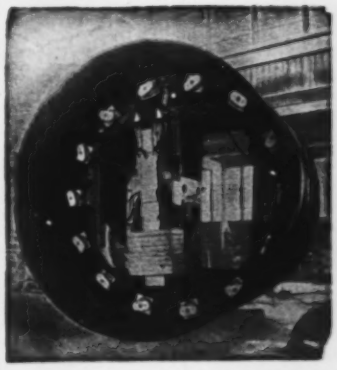

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CATALOG DIGESTS of ENGINEERING and INDUSTRIAL interest

1 AERATION IN SEWAGE & WASTE TREATMENT

Walker Process Equipment, Inc.—Jack Knife, double pivot air header assemblies and Sparjer diffusers are described and illustrated in bulletin 22-8-96. Jack Knife assemblies permit inspection of the diffusers without interrupting the aeration process and feature an air control valve built into the top pivot joint. Sparjers feature orifices made of TFE Fluorocarbon resin to provide the most clog resistant material available.

2 AEROBIC DIGESTION

The Eimco Corp.—This bulletin describes a new line of low-cost, simplified equipment for high degree purification of small sewage flows. Aerobic Digestion plants, which achieve 85-95% suspended solids and BOD reductions in treating 1000 to 200,000 GPD sewage and miscellaneous wastes, are becoming increasingly useful for institutions, airports, military bases and other enterprises remotely located from municipal sewer systems.

3 AIR ENTRAINING METER

Charles R. Watts Co.—A folder is available covering admixtures and air entraining agents and describing the Press-Ur-Meter, a device for determining the air content of fresh concrete. Said to be extremely fast, the Press-Ur-Meter follows the Klein-Walker application of Boyles Law, simplifies the usual testing procedure, using only about one tablespoonful of water, which is added on top of the sample to insure accuracy, the manufacturer reports. No adjustments for varying barometric pressure are necessary.

4 AIR METER FOR LIGHT WEIGHT AGGREGATE

Charles R. Watts Co.—Full information is available on the Roll-A-Meter, a device for testing both standard aggregate concrete and light weight concrete made of cinders, manufactured aggregate, pumis, etc., and is covered by the ASTM Designation C173-55T.

5 ALL WEATHER RUNNING TRACKS

American Bitumuls & Asphalt Company—A booklet on an approach to construction of oval tracks for track meets has been announced. This Grasstex Track (proved at the University of Florida) offers low initial cost; very low maintenance; year-round utility; and fine performance experience.

6 ALUMINUM GRATING

Borden Metal Products Co.—A brochure by way of diagrams and photos illustrates the properties and use of aluminum floor gratings. Also shown are tables of their specifications. A description of safety grating and aluminum safety steps is featured.

7 ALUMINUM GRATING

Rockwell-Standard Corporation, Grating Div.—This 6-page brochure gives engineering data on Gary Super Galok Aluminum Grating, which is non-rusting and corrosion resistant. Exclusive design provides a high strength-to-weight ratio, minimum deflection, greater installation ease and maximum safety.

8 ALUMINUM GRATING AND TREADS

Irving Subway Grating Co., Inc.—This Aluminum Grating catalog contains illustrations, descriptions, loads and spans table, weights, and other engineering data on aluminum riveted, pressure-locked grating products, for use as flooring, treads, walkways and trench covers. They are light weight, non-rusting, self-draining, self-cleaning, ventilating, fireproof and economical.

9 ALUMINUM GRATING DESIGN

Kerrigan Iron Works Co.—A catalog on Weldforged aluminum grating is offered. New forming process prevents cross bars from turning—eliminates the use of rivets, bolts and screws. It contains engineering data including safe load table and also stair tread data.

10 ANCHORAGES AND CONNECTORS

Stressteel Corp.—A technical bulletin describes in detail various methods of anchoring prestressing bars for tensioning. Also given are methods for connecting bars for greater length, as well as the use of such connections as temporary anchors for tensioning in successive stages. Special anchorages for special purposes are suggested. Detail drawing for each anchorage is shown.

11 ANTI-CORROSIVE PAINT

Eagle-Picher Co.—Permox 1-4-3, an anti-corrosive pigment, Basic Lead Silico Chromate, is described in this 8-page brochure. Its unique physical properties make it ideally suited for the formulation of primers, intermediate and finish coats. The brochure is illustrated and specific product data is given.

Please allow at least four weeks to process your requests.

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BALANCED DATA PROCESSING

12 ART AND DRAFTING MATERIALS

Chart-Pak, Inc.—A 36-page catalog gives illustrations, catalog numbers, sizes and prices of Chart-Pak tapes for charting, graphs, maps, drafting, layouts and art work. Featuring many new products, it also gives complete instructions for use of tapes, templates and other Chart-Pak pressure-sensitive materials. There are several "How-To" sections on office and plant layout, organization charts, etc., and an alphabetical numerical index for easy reference, inventory and ordering.

13 ASPHALT LINER MANUAL

W. R. Meadows, Inc.—announces the availability of a "Hydromat" Asphalt Liner Manual. The "Hydromat" Manual fully describes applications and contains installation information, necessary technical engineering data and specification information. This is not a sales catalog, but strictly a Technical Data Manual.

14 AUTOCOLLIMATING THEODOLITE

Kern Instruments, Inc.—Information is available on the Autocollimation Eyepiece, which when attached to the DKM2 1-sec Theodolite, becomes an integral part of the instrument. Total telescope magnification is 23x, working distance up to 100 ft indoors. The light source is an easily replaceable standard 3-V or 6-V bulb. The instrument can be used for normal surveying without removing the eyepiece by simply switching off the light which illuminated the reticule.

15 AUTOMATIC LEVEL

Keuffel & Esser Co.—"From Field Practice for Field Practice with the Automatic Leveling Zeiss Level N12," a 64-page booklet, offers case histories and operation details on the N12 level, an instrument with a built-in compensator. The booklet is divided into three sections. The first gives case histories showing how the N12 functions well in all temperatures and weather conditions. The second gives hints for practical uses of the N12. The third lists publications concerning leveling with the N12.

16 BASIC PROCEDURES OF SOIL SAMPLING

Acker Drill Company, Inc.—This book describes and illustrates the latest methods, procedures and tools used for soil sampling. Over 100 drawings illustrate the text. The price is $1.00 with a full refund if the reader is not completely satisfied.

N.B. There is a charge for this book. Make checks payable to Acker Drill Company, Inc.

17 BOOK OF WEIGHTS

C. W. Haasis—The weights of minerals, metal and metal products (as pipe, sheets, rods, wire, fencing) are given in this book. Also given are the weights of construction materials (as cement, sand, stone, lumber, brick, etc.) building elements (as walls, roofs, floors, etc.) and commodities (farm produce and articles of commerce). In addition the book gives foreign units of weight, weight conversion tables and weight per foot of hold space in steamers. The price is $1.25 per copy plus .15 postage.

N.B. There is a charge for this book. Please make checks payable to C. W. Haasis.

18 BORINGS

Raymond International Inc.—A booklet "Subsoil Investigations for Foundations" Catalog B-7 explains the reason for subsoil investigations, what Gow borings are and how they are made, and the results obtained. Illustrated are methods for making borings and taking samples, and various types of rigs in operation.

There are 260 Digest items on pages numbered 138 to 161. Read all items for the literature of interest to you.

19 BRIDGE BEARINGS & PLATES

Lubrite Div., Merriman Bros., Inc.—This literature provides complete information about Lubrite Expansion Plates and Bushings with typical suggested design details and technical data. Lubrite Bearings are completely self-lubricating and do not require periodic maintenance or servicing. The bearings are applicable to steel and concrete structures. Special design provides for rotation of beam, due to deflection, as well as for the normal therman expansion and contraction of the span.

20 BRIDGE DECKING

Irving Subway Grating Co., Inc.—The 12-page catalog on Irvico Decking for bridges contains illustrations, descriptions and engineering data on metal grid bridge flooring, including the special beam type decking and the new C-K surface. It points out the features which include light weight, cleanliness, drainage, safety, durability, traction, strength and economy.

21 CALCIUM CHLORIDE IN CONCRETE

Calcium Chloride Institute—A 40-page technical manual on "Calcium Chloride in Concrete" is available for users of concrete. It contains data on major effects of calcium chloride: early and ultimate strength, cold weather protection, high early strength cement, and air entrained concrete. The manual contains a section on special conditions where calcium chloride is used advantageously—and there are several specifications in the booklet.

22 CALCIUM CHLORIDE SOLUTION

Calcium Chloride Institute—"How to Prepare Standard Calcium Chloride Solution" is explained in this pamphlet. Prepared especially for ready mixed concrete producers, it contains illustrated recommendations for procedure in making solution, and a chart on recommended gallons of solution per batch. It also includes information on proved commercial and shop-made automatic dispensers.

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these Compactors and Vibrators —

MODEL GVR 100-C RAMMER, 450 to 650 blows per min., wt. only 115 lbs. Compacts all types of soil including clay.

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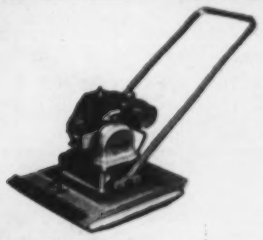

MODEL VPG 1500 VIBRO PLATE, 1700 lbs. impact -- 5,000 per min., 19"x24" effective area of compaction, wt. only 135 lbs. Ideal for compacting sand and gravel. Built-in water sprinkling system for hot or cold mix asphalt patching.

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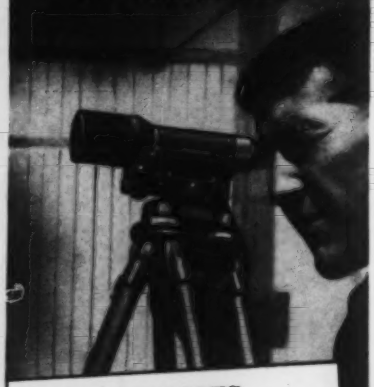

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CATALOG DIGESTS

23 CARPULLERS

Superior-Lidgerwood-Mundy Corp.—A 24-page 2-color bulletin C-616 "Carpullers for Easy Moving Rolling Loads" is available, with descriptions, illustrations, data, tables, and specifications for Carpuller requirements. Illustrates and describes the Electric Capstan Carpuller for car moving, barge moving, pipe bending or any haulage of similar nature; also Tugmore Capstans, Horizontal Head type Capstan Carpullers, Drum Type Carpullers, Friction Drum Type Carpullers, etc.

24 CAST-IN-PLACE CONCRETE PIPE

No-Joint Concrete Pipe Co.—This company offers a pamphlet describing the no-joint concrete, cast-in-place, pipe laying process in detail. Among the advantages of no-joint pipe is the fact that the cast-in-place pipe forms a near perfect bond with the bottom and supporting sidewalls of the trench, giving added strength to the pipe.

25 CAST IRON PIPE

U. S. Pipe & Foundry Co.—An 8-page booklet on centrifugally cast, Tyton Joint pipe for water or other liquids. The newly developed Tyton Joint is simple, sturdy, and tight. Illustrations show details of joint and method of assembly.

26 CAST IRON PIPE, HYDRANTS AND VALVES

R. D. Wood Company—A general catalog is available providing full details of weights and dimensions of "sand spun" cast iron pipe and cast iron fittings. This catalog also features fire hydrants, gate valves, and other products manufactured by this company.

27 CATIONIC BITUMULS

American Bitumuls & Asphalt Company—After extensive testing, the company is offering an entire line of Cationic Emulsified Asphalts. The booklet covers every phase of application, from surface treatments to mixing operations. Of all developments in the paving field, this appears to have most promise because it permits re-activation of old, bypassed aggregate sources and less concern for early rain.

28 CAVITATOR AERATORS

Yeomans Brothers Co.—A 12-page catalog describes this mechanical aerator for treatment of domestic and industrial wastes by either aerobic digestion, or activated sludge process.

29 CEMENT LININGS

Centriline Corporation—The Centriline Process for cement mortar lining steel, cast iron, concrete and terra cotta pipelines in place and which has been available in the diameters 16 in. to 144 in. can now be used in pipelines as small as 4 in. in diameter. This new adaptation of the Centriline Process for small pipelines eliminates the necessity for excavations at laterals and corporation cocks and is fully described in the new illustrated catalog.

30 CLAY PIPE

National Clay Pipe Manufacturers, Inc.—This 48-page fully illustrated brochure entitled "The Story of Clay Pipe" contains an historical record of clay pipe, its contribution to America from the beginning of the 20th century to the present, and a look into the future of American homes, industries and communities.

31 CLAY PIPE

National Clay Pipe Manufacturers, Inc.—A 6-page brochure, "Lifetime Vitrified Clay Pipe," is of particular interest to professional engineers. It contains lists of ASTM, ASA and AASHO specifications applicable to vitrified clay pipe, and describes new factory-made pipe joints. Clay processing today, and the typical characteristics of vitrified clay pipe also are included.

32 COFFERDAMS

Spencer, White & Prentis, Inc.—"Cofferdams," by Lazarus White and Edmund Astley Prentis is a trusted source-book covering actual design and construction of cofferdams as well as the theoretical features. The price is $10.

N.B. There is a charge for this book. Make checks payable to Spencer, White & Prentis, Inc.

33 COLD WEATHER CONCRETING

Sika Chemical Corp.—Complete information on the acceleration of the setting of concrete during cold weather is available. The booklet includes test data, specifications and technical information on Sikacrete accelerating densifier.

34 COMMERCIAL LINER PLATES

Commercial Shearing & Stamping Co.—This new 20-page bulletin describes commercial liner plates for support of excavation in tunnel and shaft construction. Included in the bulletin are specifications of the plates and illustrations of some representative liner plate installations.

35 COMMERCIAL POOLS

National Pool Equipment Co.—This 16-page commercial pool brochure in full color features many of the outstanding public pool installations throughout the U.S. This pictoria publication highlights motel, community, club, military and university pools with general layout and sizes.

36 COMPACTION METHODS BOOKLET

The Galion Iron Works & Mfg. Co.—Booklet No. SR-31, an informative, well-illustrated, non-technical, 16-page pamphlet covering all types of rollers and other compaction equipment has been published. This treatise will be especially helpful to anyone who has previously had no opportunity to study the subject of soils and materials compaction, the problems encountered, and the application of the various types of equipment available.

37 COMPACTOR AND VIBRATOR

Wacker Corp.—The GVR 100-C rammer is described in this folder. Capable of delivering 450 to 650 blows per min, this lightweight rammer compacts all types of material, such as clay, sand, gravel, earth and asphalt patching. Also described is the VPG-1500 Vibro-Plate with a forward speed of 30 ft per min. It delivers more than 1700 lbs impact at 5000 per min, 50% lighter than other vibratory plates, the VPG-1500 is ideal for finishing sandy or granular material, hot or cold asphalt and for densifying concrete and other stabilized materials.

38 COMPOSITE CONSTRUCTION

Nelson Stud Welding Div. of Gregory Industries, Inc.—A comprehensive bulletin explains what composite (concrete and steel) construction is, how it works, its various advantages and economies and how it has been used in all types of building construction.

In filling out the coupon, please print clearly and be sure that you furnish a complete address.

39 COMPOSITE PRESTRESSED CONCRETE-STEEL TRUSSES

Stresssteel Corp.—A technical bulletin describes a new design in bridge construction employing composite prestressed concrete-steel trusses. The bridge is a heavy duty logging structure in the Cascade Mountains of Washington. Each truss is 100 ft long and 6 ft deep, with a steel top cord and a concrete bottom cord post-tensioned with Stresssteel Bars. Detailed drawings are presented and reasons given for choosing the composite truss rather than an all-steel or concrete member.

40 CONCRETE ADHESIVES

Thiokol Chemical Corp.—This new 8-page bulletin describes important applications for polysulfide-base concrete adhesives in concrete construction and repair. It illustrates the basic techniques using adhesives for resurfacing and patching pavement either with portland cement concrete or by means of quick-setting "adhesive/aggregate" mortars. Also noted are methods for skidproofing pavement and surface sealing pavement and structures.

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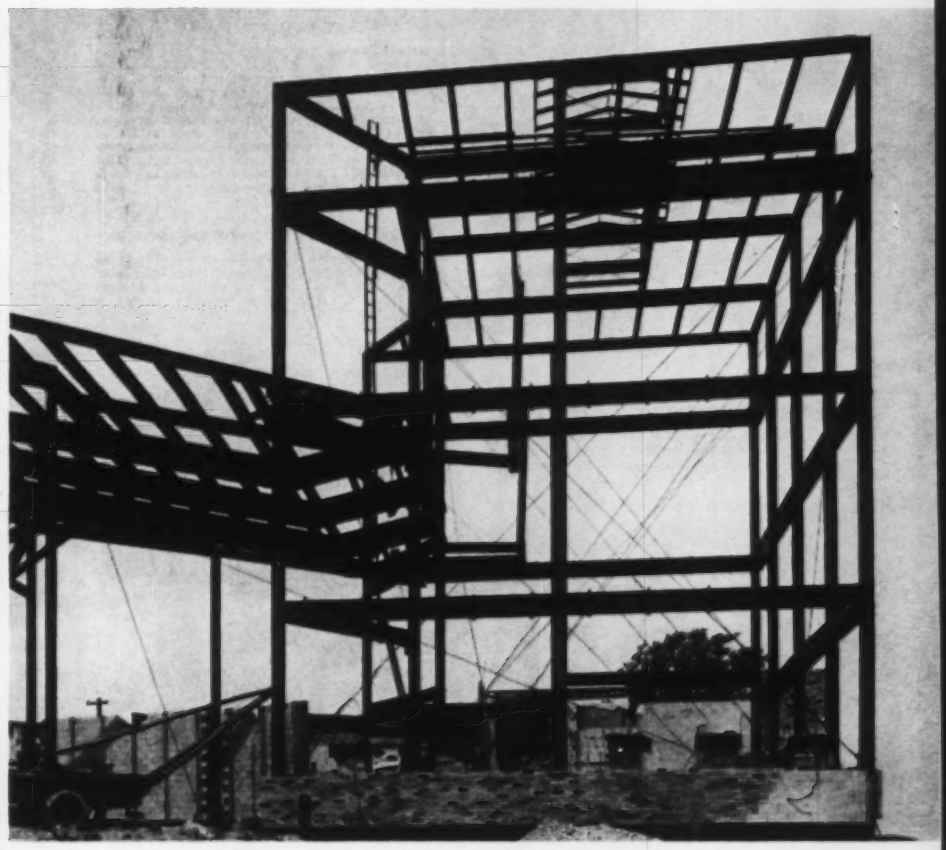
QUALITY STEEL CONSTRUCTION BY PITTSBURGH-DES MOINES



Most anyone can "put up steel" for a badly-needed school—and often does! But the difference between well-fabricated, well-timed, guaranteed PDM steel construction and lesser kinds is the difference between satisfaction and regret for all concerned. With structural steel fabricating plants in Baltimore, Pittsburgh, Des Moines, Clive, Iowa, and Fresno and Santa Clara, Calif., plus skilled field supervision and top craftsmanship in erection, Pittsburgh-Des Moines provides *the right start* for school projects of any size and complexity. For the first dividend of satisfaction on your new-school investment, trust the steel to PDM! *Let us consult with you.*

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STEEL CONSTRUCTION

Pittsburgh-Des Moines Steel Company

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41 CONCRETE AND MORTAR ADMIXTURE

Sonneborn Chemical & Refining Corp.—A new, 12-page booklet describes Triple Action Trimix, an admixture for concrete and mortar that accelerates hardening, increases early strength and reduces water requirements. The triple action benefits described in the booklet, produce uniformly better concrete in a shorter time at a lower cost.

PLEASE PRINT NAME CLEARLY

42 CONCRETE BUCKETS

The Heltzel Steel Form & Iron Co.—Efficient, easy-to-use, safe concrete buckets are the subject of this 4-page bulletin. Standard features of the Heltzel concrete bucket include: durability, light weight, 4-position discharge control, gear controlled double arc clamshell gates and a heavy steel base ring. The bulletin contains tables of the various model buckets, their sizes in cu yd, diameters, gate size, volume, height and weight.

43 CONCRETE DUMPER

Maxon Construction Co., Inc.—The Dumpcrete, a low cost method for hauling and placing concrete quickly, is described in a 4-page folder. The Dumpcrete is good for paving jobs, light jobs, heavy jobs and utility jobs. It can be used to haul sand and aggregates, dirt, or water as well as concrete.

44 CONCRETE FOR STADIUMS AND AUDITORIUMS

The Master Builders Co.—Concreting problems encountered and solved in the construction of 16 stadium and auditorium projects in this country and abroad, are explained in this 20-page Master Builders Co. publication. The role played by "Pozzolith" in acquiring the desired handling properties of concrete during placement and to meet exacting requirements for hardened concrete is also stressed.

45 CONCRETE FORMING

Universal Form Clamp Co.—A 16-page booklet on items of interest to contractors and engineers on concrete forming is available without charge.

46 CONCRETE FORMING SYSTEM

Economy Forms Corporation—A catalog with pictures is offered showing a complete forming system available to contractors on a purchase basis. The easy adaptability of these forms to all types of form work, plus engineering layout service on each new project, together with a complete steel form good for a lifetime of service makes the EFCO form an attractive investment for the large and small builder. Also available, a four-page leaflet covering forms for prestressed or precast concrete beams, etc.

47 CONCRETE PIPE COUPLING—AMBAND

American-Marietta Company—A pamphlet on Amband fiber glass reinforced resin couplings used with double spigot, rubber gasketed concrete pipe. To be used for pressure heads up to 125 feet, for infiltration as low as 100 inch-gallons per mile per day. Amband couplings withstand corrosive action.

48 CONCRETE SPREADER

Maxon Construction Co., Inc.—The Dumpcrete Spreader loads in 60 seconds, spreads in 15 seconds, moves and strikes-off in 15 seconds. This 4-page folder describes the spreader in detail, giving features and applications. The spreader is available for both single-lane and full-width paving.

49 CONCRETE TESTING MACHINES

Forney's Inc., Tester Div.—A revised catalog is offered describing a complete line of concrete testing machines for plant, jobsite and laboratory testing of cylinders, cubes, beams, blocks, tile and pipe. Capacities range from 60,000 to 500,000 lb. Also described is a complete line of collateral concrete testing apparatus including L.A. Abrasion Machines, Cube and Beam Molds, Cylinder Molds and Capping Apparatus, Slump Cones, Kelly Balls and Air Meters.

50 CONCRETE WATERSTOPS

Water Seals, Inc.—Labyrinth® Waterstops are manufactured of polyvinyl plastic, which helps maintain a constant, strong, watertight bond between concrete joints. A catalog describes the convenient features of Labyrinth® Waterstops, including those which render it resistant to age, chemical and weathering changes. Blueprint type specification drawings include the Labyrinth, Flextrip, Cellular and Dumbbell waterstops in their various sizes. A table lists the recommended joint application and water head for each size and kind of waterstop.

51 CONSTRUCTION MACHINERY

Allis Chalmers Mfg. Co., Tractor Group—A 16-page, 2-color booklet describes the company's line of construction machinery, utility tractors, gasoline and diesel power units. It includes brief specifications on crawler tractors, dozers, sidebooms, crawler and wheel tractor loaders. Also included are motor scrapers, rear-dump rock wagons, pull-type scrapers and motor graders.

52 CONTRACTOR'S SUBMERSIBLE SUMP

Pacific Pumping Co.—The portable electrically driven units described in this bulletin, require no suction hose and are simply lowered into the excavation to be unwatered. They are said to pump whatever water comes in even if it is only 5% of the pump's capacity and to operate in muddy water or sludge, under flood or semi-dry conditions, in hot or freezing climate. The pump case is rubber-lined with a tough alloy impeller to resist the wear of abrasives, sand or mud. The pump case is a light weight alloy and will resist the action of salt water.

PLEASE BE PATIENT
YOUR REQUESTS TAKE TIME

53 CONTRACTORS TRANSIT

Warren-Knight Co.—An all new, American made Contractors Transit, constructed entirely of brass and bronze with special steel double center and clamps and tangent screws, is described in this brochure. Features of the transit include: internal focusing 24x power telescope with clamp and tangent screw and full verticle circle reading to single minutes; horizontal circle and vernier reading to single minutes, no compass. The instrument is complete with wide frame tripod, newly designed hardwood carrying case and accessories.

54 COPYFLEX DIAZOTYPE REPRODUCTION PROCESS

Charles Bruning Co., Inc.—A 12-page illustrated booklet describing the Copyflex diazotype reproduction process is now available. The booklet explains the various types of direct-positive prints possible with Copyflex, including black-line or color-line prints on white or tinted stock; multi-color films for projection and overlays; translucent duplicate originals; dimensionally stable film and glass cloth prints; and reflex prints on translucent film.

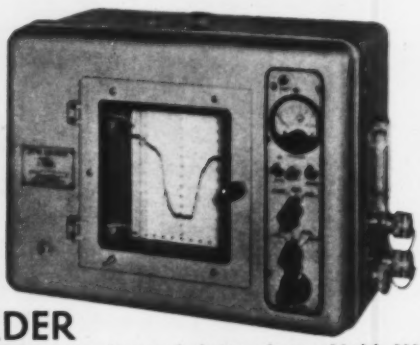
55 CORE DRILLING EQUIPMENT

Sprague & Henwood, Inc.—This catalog containing all of the bulletins describing a complete line of core drilling equipment, includes core drills, auxiliary drilling equipment, "oriented" diamond bits, sampling equipment and pumping units. Recent additions to the catalog include a new bulletin on the Models 40-C and 40-CL Core Drills. The section on auxiliary equipment has recently been expanded to include air and mud core barrel, large diameter single tube corebarrels and 4-in flush coupled casing.

NEW from Edo

MODEL 555
SURVEY
DEPTH RECORDER

NEW RELIABILITY!
NEW SERVICEABILITY!



Improved design of new Model 555 Survey Depth Recorder means greater accuracy, ready accessibility of all components for maximum servicing ease.

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Light in weight (only 55 lbs.), easy to operate and extremely accurate, Model 555 is suited to temporary or permanent installation aboard vessels of every size. The new superheterodyne receiver assures sharp, precise recordings, while Edo's new Model 480 transducer, a barium titanate block type, improves sensitivity and definition 100 per cent.

Model 555 gives permanent readings on over-lapping range scales from 1½ feet to 230 fathoms. The wide transducer beamwidth—20 degrees at minus 10 db points—provides excellent penetration and broad coverage for all types of general underwater survey.

Send for brochure, Dept. V-4.

Edo CORPORATION, College Point, L. I., N. Y.

56 "CT" DESTRUCTOR

Morse Boulger, Inc.—Literature is now available on the "CT" Destructor, an incinerator with two features designed to make it easy to operate. The first is a dump and shaker lever which facilitates ash removal by eliminating bending and shoveling, and the second is a swing away charging door which keeps its hot surface away from the operator during charging.

57 CURVE CROWN PULLEY

Stephens-Adamson Mfg. Co.—The availability of Bulletin 558 on the new Curve Crown welded, all steel Pulley has been announced. The literature features comprehensive technical and engineering data, specifications, diagrams and illustrations.

58 DATA PROCESSING SYSTEM

Bendix Computer, Div. of Bendix Aviation Corp.—A 20-page brochure describing the new G-20 high-speed data processing system. The brochure is fully illustrated in several colors, and describes the new system in both technical and non-technical language.

In filling out the coupon, please print clearly and be sure that you furnish a complete address.

59 DATA PROCESSING SYSTEM

International Business Machines Corp.—Two useful programs for the highway engineer, the computation of earthwork quantities and the analysis of surveys, are presented in this 12-page booklet. The IBM 1620 data processing system described in the booklet is especially suited to the needs of the civil engineer. Problems in highway engineering, bridge design, hydraulic and structural engineering can be given to the IBM 1620.

60 DENSION CORE BARREL

Acker Drill Co., Inc.—offers free of charge, a copy of Bulletin 1100, which describes the Dension Core Barrel. Acker has obtained exclusive manufacturing rights to the tool. The brochure illustrates and describes how the core barrel operates. The cutaway drawing of the barrel shows all of the important operational features.

61 DEPTHOMETER, UNDERWATER CAMERA, METAL LOCATOR

Bludworth-Marine—Literature is available on a precision, lightweight Survey Depth Recorder, Bludworth Marine Model E.S. 130 which is portable, weighs under 40 lbs and performs with great flexibility. This instrument features the new narrow beam single transducer. Also provided is information on an underwater TV camera, UTH-4R, with a continuous monitor screen on boat or land with depths to 180 ft. Also, an Underwater Metal Locator that pinpoints ferrous and non-magnetic metals in fresh and salt water, is described. Pressurized to depths of up to 160 ft, this locator weighs 1½ lbs submerged.

62 DESIGN MANUAL

W. R. Meadows, Inc.— has prepared a manual entitled "Design Techniques for Controlling Moisture in Building Structures." This manual, prepared by a firm of technical engineering writers, was originally planned to sell for $1.00 per copy. However, as this problem is of vital interest to all in the construction industry, this company will now send a free copy to all architects, engineers and builders who desire a copy for their file.

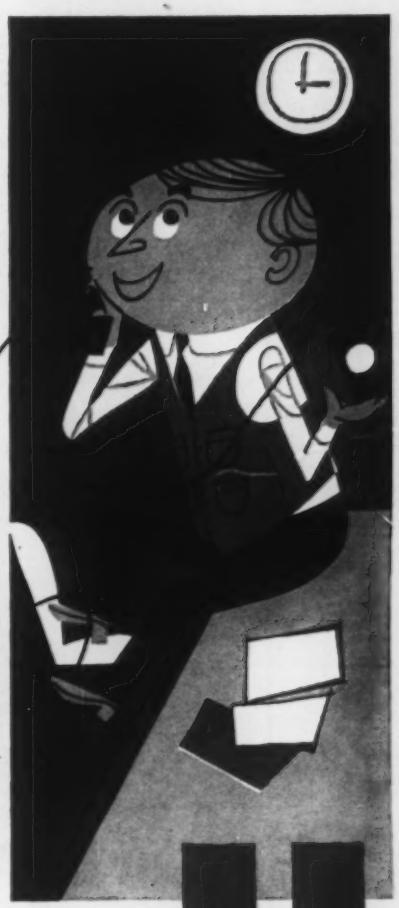
63 DIAMOND BIT AND CORE BARREL

Acker Drill Company, Inc.—Bulletin 10 describes and illustrates the company's complete line of diamond bits and core barrels. The core barrel illustrations are shown as cutaways to facilitate the reader's interpretation of construction and drilling.

64 DIAMOND MASONRY BITS

Sprague & Henwood, Inc.—All three types of this company's Diamond Masonry Bits, resettable, throw-away and impregnated, are described in a new 4-page bulletin. In addition, the bulletin describes the various items of accessory equipment used in this type of drilling. These Diamond Masonry Bits ensure fast, low-cost drilling through reinforced concrete, brick, ceramics, asphaltic concrete, stone and plastics.

Answers time-saving, labor-saving problems...?



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FOR CONCRETE BRIDGE DECKS

eliminates material waste, time schedule delays, removal expense and hazardous operations. Send for free details on this modern construction method.

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Highway Guard Rail
Bridge Flooring
Steel Forms for Concrete Bridge Decks
Corrugated Metal Pipe
Window Wells
Metal Doors & Frames
Metal Buildings

United Steel Fabricators, Inc. Wooster, Ohio

65 DIGESTER CIRCULATING-MIXING EQUIPMENT

Walker Process Equipment Inc.—The Gaslifter is an exclusive development for circulating and mixing digester contents. Grease and scum blankets and bottom deposits are eliminated resulting in increased digester efficiency and capacity. The Gaslifter utilizes digester gas, through the air lift principle to effect the circulation action. Bulletin 25-8-91 furnishes details and photos of installations.

66 DIGESTER SLUDGE HEATING EQUIPMENT

Walker Process Equipment Inc.—The Heatx for digester sludge heating is presented in Bulletin 24-8-82. Designed specifically for sludge heating the Heatx features a custom burner and heat exchanger combined with a separate boiler to furnish the most efficient system available. The units operate on digester gas with automatic switchover to either natural gas or oil for auxilliary fuel. Capacities range from 110,000 to one million btu/hr.

Turn to page 138 and order your literature.

67 DOUBLE-SEALING FASTITE JOINTS

American Cast Iron Pipe Company—This revised illustrated 12-page brochure describes the advantages of the double-sealing, single gasket Fastite Joint. It contains instructions for assembly, weights and dimensions, and typical installations of American Fastite pipe for water, sewage and other liquid service.

68 DRAFTING FILM-DURALAR TECHNIQUE

J. S. Staedtler, Inc.—The drafting film-Duralar method is described in this bulletin. Also described are the correct technique for drafting with Mars Duralar pencils on drafting film and the "wash-and-print" system. Grime can be safely washed off the film, leaving the Duralar lines sharp and clear, eliminating the need for costly re-drawing.

69 DRAFTING MATERIALS

A. Lietz Company—A new, complete line of AG pressure-sensitive drafting materials manufactured by Applied Graphics Corp. is now being distributed by this company. This catalog describes over 2,000 items in the new line, including such useful aids as templets, grid sheets, die-cast symbols, numbers, letters and printed-circuit symbols.

70 DRAIN GRATES

Irving Subway Grating Co., Inc.—A four-page, two-color folder illustrating the use of open mesh steel flooring as drain grates is available. The folder contains photographic illustrations and shows typical uses of drain grates. There are engineering drawings of the various types and complete technical data to facilitate estimates and specifications.

71 DRILL SUPPLIES

Acker Drill Co., Inc.—Over 150 tools and accessories used in diamond core drilling, shot core drilling, driving casing, etc., are described and illustrated in this bulletin.

72 DUBL-PANL ROOF-CEILING SYSTEM

Behlen Manufacturing Co., Inc.—This bulletin describes Dubl-Panl roof-ceiling units, wall units, and cantilever overhangs of light gauge metal. Among the other advantages listed is the fact that the fewer and lighter materials that go into the units produce less dead load, allowing reduction in wall and footing materials in many cases.

73 "DU-O-JECT" PNEUMATIC EJECTOR LIFT STATION

Smith & Loveless—A 6-page bulletin on the factory-built "Du-O-Ject" pneumatic ejector sewage lift station is offered. This duplex unit features two compressors, dual piping and two receivers for stand-by dependability. It is available in complete engineering data manual on sewage lift stations with specifications and design notes.

74 ELECTRIC GENERATOR SETS

Fairbanks, Morse & Co.—Stationary, portable and mobile electric generator sets are presented in this 12-page booklet. Included are general applications, and specifications of the different models shown.

75 ELECTRONIC COMPUTER

Bendix Computer, Div. of Bendix Aviation Corp.—This 8-page report describes how 27 varied firms use the G-15 digital computer to automate mechanical engineering design. Applications vary from the design of heavy power equipment to aerodynamics.

76 ELECTROTAPE

Cubic Corp.—This bulletin describes the firm's Electrotape, precision electronic surveying equipment. Features of the two-station system described in the brochure include the interchangeability of stations for greater flexibility, highest accuracies, ease of all weather operation and overall economy. The Electrotape system is said to make measurements from 250 ft to over 50 miles with accuracies of 3 ppm plus or minus one inch.

77 ELEVATED STEEL TANKS

Chicago Bridge & Iron Co.—A new 20-page brochure describes Horton Elevated Steel tanks for water storage in capacities from 15,000 to 3,000,000 gallons. Featured designs are spheroidal, ellipsoidal and radial cone. Included is a description of the function of elevated tanks in both public and private water systems. The brochure is well illustrated with photographs of existing structures.

PLEASE BE PATIENT
YOUR REQUESTS TAKE TIME

78 ELEVATED TANKS

Pittsburgh-Des Moines Steel Co.—Details of the several different types of elevated steel tanks, including capacity, ranges, tank dimensions, and other factors to be considered in the selection of storage tanks. Also available, 4 pages of pictures and discussion about flat bottom water storage.

79 ELLIPTICAL CONCRETE PIPE—LO-HED

American-Marietta Co.—This pamphlet covers elliptical Lo-Hed Reinforced Concrete Pipe for culverts and sewers. Specifications are given for the complete range of sizes from the equivalents of round pipe 18-in. I. D. through 144-in. I. D. Illustrations show results of pressure tests and installations of Lo-Hed pipe being made on various types of jobs.

80 ENGINEERING BOOKS

The Ronald Press Co.—A revised brochure on 29 up-to-date, authoritative books is offered. Of prime interest to civil engineers are books covering such subjects as: power plant theory and design, air conditioning, soils engineering, substructure analysis and design in metals, linear structural analysis and statically indeterminate structures.

81 EPOXY COMPOUNDS

Sika Chemical Corp.—This folder describes a variety of construction applications of new thermosetting plastics. These materials exhibit physical properties exceeding those of most comparable modern construction materials. Applications described include joint sealing and crack sealing, bonding and patching, repaving and coating of concrete slabs.

NOW!
FASTER SOILS TESTS...
MORE TESTS...

...WITH THE SAME MANPOWER!

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Dens-o-meter

THE KEY TO ACCURATE FIELD TESTS FOR MOISTURE-DENSITY IN EMBANKMENT AND FOUNDATION SOILS.

The DENS-O-METER is light in weight, compact, very portable, easy and economical to operate and maintain!

Developed after years of research by Department of Highways, State of Washington. Opens up entirely new possibilities for foundation and soils engineers and contractors who can now make accurate moisture-density and compaction tests, quickly and easily.

- **in small or large holes up to 3 ft. deep**
- **in all types soils—fine or coarse granular base materials**
- **in approximately 3 minutes after hole is dug**

CONTRACTORS AND ENGINEERS: Stop over-compaction, under-compaction . . . make moisture-density determinations many times daily with a DENS-O-METER.

GET FULL INFORMATION FROM EXCLUSIVE SALES AGENTS

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82 EXPANSION PLATES & BUSHINGS

Lubrite Div., Merriman Bros., Inc.—Manual No. 55 contains complete information, technical data, and specifications about Lubrite self-lubricating expansion plates and bushings for bridges, buildings, refinery equipment, chemical processing equipment high temperature, missile and atomic applications. Lubrite plates or bushings are completely self-lubricating and do not require periodic maintenance or servicing. Ideal where ordinary lubrication is objectionable, neglected, expensive to maintain or for inaccessible plates or bushings.

83 FIBRE FORMS

Sonoco Products Co.—Uses of Sonotube, fibre forms, are illustrated in a brochure. These fibre forms provide an economical method of forming round, obround, half-round and quarter-round columns. Also encasement of steel and wooden piles, existing columns and utility risers. Available in several different types, the newest which provides a form surface requiring little or no rubbing of the finished column. Technical data also available.

Return the coupon today!

84 FIBRE TUBES

Sonoco Products Co.—Sonovoid, fibre tubes, were specifically developed to form voids in bridge decks; wall, floor, roof and lift slabs and in concrete piles. Uses illustrated in a brochure. Sonovoid, fibre tubes, are used in precast or cast-in-place units of conventional or pretensioned construction. Tie down and spacer method shown along with design data for 8-in. and 12-in. slabs. Other technical data available.

85 FIELD EQUIPMENT

Warren-Knight Co.—The Warren-Knight Catalogue, Part I, of Engineering Field Equipment (24 pages) has been revised and reprinted and is now available. This book includes photographs and descriptions of standard field equipment and supplies including Builder's Instruments, Compasses, Measuring Tapes, and practically everything needed for the Engineer and Builder for Field use. Paragraphs pertaining to instrument care and repair are included. Part II with a complete description of drafting equipment and supplies (48 pages) including everything needed for the drafting room is also available for free distribution.

86 FILTER MEDIUM

Anthracite Equipment Corp.—The free catalog, "Anthrafilt Hard Coal Filter Medium" gives complete technical data on the sizes and uses of "Anthrafilt" as a filter medium for municipal and industrial filters. It outlines the advantages of "Anthrafilt" over sand as a filter medium.

87 FLEXIBLE GASKETS

Hamilton Kent Mfg. Co.—A 16-page manual, illustrated in color, provides full details, engineering information and functional diagrams on 5 different types of gaskets for jointing any type of concrete pipe sewerage and drainage line. The gaskets are of true compression type, capable of withstanding head pressures up to 50 feet. They come in either rubber or neoprene.

88 FOUNDATION CAISSONS AND PILES

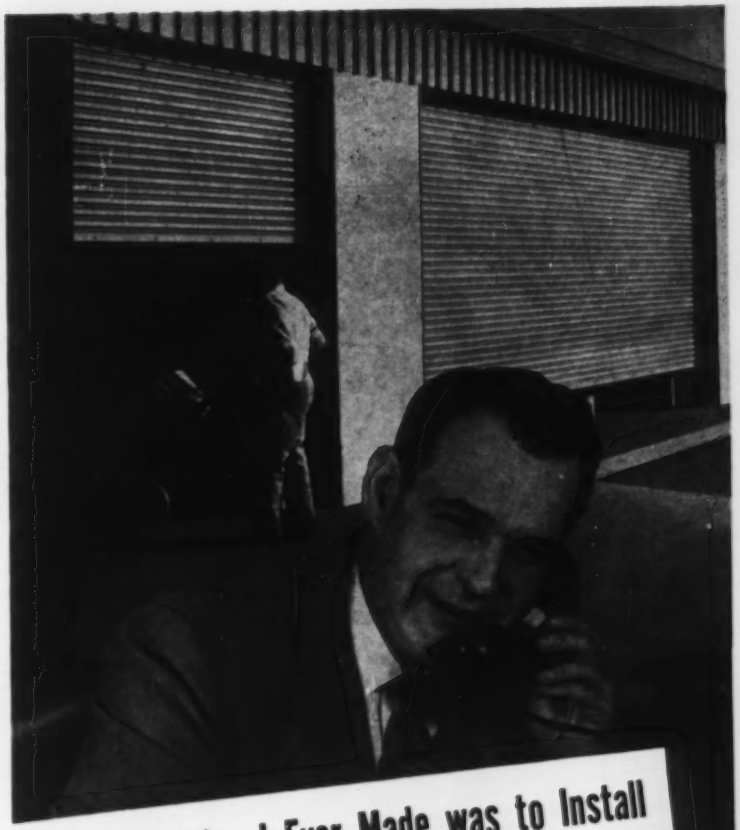
Franki Foundation Company—An interesting, informative and well-illustrated brochure describes in detail the Franki method of installing Displacement Caissons and Pressure Injected Footings. Caisson load test results on representative projects and reinforced concrete cap design data are noted.

89 GALVANIZED STEEL FORMS

United Steel Fabricators, Inc.—The galvanized steel forms for concrete bridge decks, described in this bulletin, assure safety, efficiency and economy in deck construction. Included is a discussion of special features among which is simplicity of erection. There are also a table of allowable clear spans in inches and some section drawings of the forms.

90 GAUGE

Nuclear-Chicago Corp.—The surface and depth measurement of moisture content and density of soils, concrete, asphalt and other construction materials used in the highway, airfield, dam and building construction industries is described in detail in the new "d/M-Gauge" brochure. The "d/M-Gauge" is a modern, portable system of instruments using the Nuclear, non-destructive method of determining moisture and density in as little as two minutes per measurement.



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Kinnear Rolling Doors are made any size, with motor, manual or mechanical controls. Easily installed in old or new buildings. Kinnear's heavy galvanizing assures lasting resistance to the elements, and Kinnear Paint-Bond permits quick, thorough paint coverage with maximum paint-grip. Write for full details.

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91 GEAR DRIVE

Johnson Gear & Mfg. Co.—Right angle gear drives for vertical shaft pumps and industrial use such as sewage disposal, water supply, fire and flood control, cooling tower installations and barge service, are described and illustrated in Bulletins #31 and #32. Many new features have been added including the Redi-Torque drive for automatic installation.

92 GEARS

The Earle Gear and Machinery Company—A twenty-page catalog describes in general, the kinds and sizes of gears manufactured by this company. Its contents deal with spur gears, bevel gears, helical gears, worm gears, racks, non-metallic gears, sheaves, sprockets, special machinery of which gears form a part, and special gear information. Illustrated with photographs, it also shows actual Earle installations.

93 GENERATING SET

Katolight Corp.—Information is available on a new 125 KW generating set, developed to meet emergency requirements in modern industrial plants, institutions, hospitals and public buildings. The major features are the unitized compact design, available in all standard voltages equipped with either close regulating static or rotating exciters, and voltage regulators. In writing for further information, Katolight will send a complimentary copy of their "Life of the Party" songbook.

RETURN THE COUPON TODAY FOR IMMEDIATE RESULTS!

94 GKO LEVEL WITH ERECTING EYEPIECE

Kern Instruments Inc.—This model in the famous Kern Surveying Instrument line was especially designed for the U.S. market. In addition to the Erecting Eyepiece, the instrument is easier and more comfortable to operate and may be used on a Theodolite Tripod with an adapter plate.

95 GLASS LINED CLAY PIPE

American Vitrified Products Co.—A glass lined sewer pipe, called the most outstanding house-to-street sewer and house drain pipe for modern home requirements, is described in this 4-page booklet. Included are illustrations of advantages to this pipe, and a step-by-step illustration of installation procedures.

96 GRATING FLOORING AND TREADS

Irving Subway Grating Co., Inc.—General Grating Catalog F400 contains illustrations, descriptions and complete engineering data on full line of grating products made in steel, aluminum and other metals. Catalog shows riveted, welded and pressure-locked types for use as flooring, treads, walkways, trench covers, and so on. Irving grating is safe, durable, self-draining, ventilating, clean, fireproof, economical.

97 GRATINGS

Borden Metal Products Co.—A 16-page catalog shows the three basic types of grating construction; more than 30 dimensional drawings of subtypes; eight safeload tables covering steel and aluminum gratings, roadway grating and sidewalk slabs plus other tables on panel widths, tread widths, floor armor, etc. Also shown are the various safety treads and their nosings. Included are the steps for careful planning and checking of the job.

98 GRAVITY SEWER PIPE

Keasbey & Mattison Co.—Asbestos-cement gravity sewer pipe, designed for economical, long life non-pressure sewer systems, is described in a 4-page folder, AP-22. Profusely illustrated, it points up savings in design, installation and operation with asbestos-cement pipe. Complete dimensions, tolerances as well as other specifications needed by the engineer are included.

99 GREATER VISIBILITY

The Eimco Corp.—This folder demonstrates the greater visibility and safety with the up-front operator position unique with this line of crawler-tractors. It gives degrees of visibility in all directions from this and from selected competitive machines and outlines many of the other features of the 103, the 105 and the 106 series of tractors, dozers, front end loaders, excavators and log loaders.

100 GUYED AND SUSPENDED STRUCTURES

John A. Roebling's Sons Division The Colorado Fuel & Iron Corp.—This publication contains information required for selection and preparation of specifications for wire, strand and rope used on guyed structures and suspended systems of all kinds, except major suspension bridges. Both standard and special fittings for use with bridge strand and bridge rope are shown.

Turn to page 138 and order your literature.

101 HEAVY-WELD

Rockwell Standard Corporation, Grating Div.—Gary Heavy-weld is covered in this new, 8-page booklet. Included are complete engineering data and special design information on highway drainage and aircraft applications.

102 HELICOPTERS

Hiller Aircraft Corp.—Helicopters in the 1961 line are described in a new 12-page folder. The 12/E 3-place model and the new E/4, for the fields of construction, mineral and oil exploration, executive transportation, lumber and forestry, municipal and utilities, are described in the folder. Information is included on the power kit which adds extra power to perform extra duties. Complete dimension and performance specifications are given.

103 HI-CONE AERATOR

Yeomans Brothers Co.—The high-intensity, high-capacity surface aerator for secondary sewage and waste treatment by the activated sludge, or aerobic digestion processes is described in an illustrated, 12-page catalog. No limits on flows handled.

104 HIGH STRENGTH BARS

Stressteel Corp.—This technical bulletin describes a number of interesting applications where the high strength characteristics of Stressteel Bars were employed to tie together various structural elements. The advantages of reduction in weight and the ease of handling the lighter bars are discussed. Specific examples demonstrating the versatility of the applications are given, with accompanying sketches describing in detail the way the bars were used and the structural effects achieved.

105 HIGH STRENGTH BOLT

Russell, Burdsall & Ward Bolt and Nut Co.—Savings of up to 40% in bearing-type connections can be achieved through the use of a new high strength bolt described in this 4-page bulletin. The larger head and shorter thread length of the new bolt design offer substantial advantages: for erectors, savings in fastening time and materials cost; for fabricators, faster and less expensive production; for designers, specified shear strength with reduced number of bolts.

106 HIGH-TENSILE BOLT

Automatic Nut Co.—Descriptive literature on a new type high-tensile, interference-body structural bearing bolt with rolled interrupted ribs, is now available. The bolt gives a high clamping force and body-bound fit in a structural joint. It is designed with the proper length of rib for the thickness of the plates, preventing the riding of any steel on the bolt threads. The full thickness of the plates is in bearing at all times.

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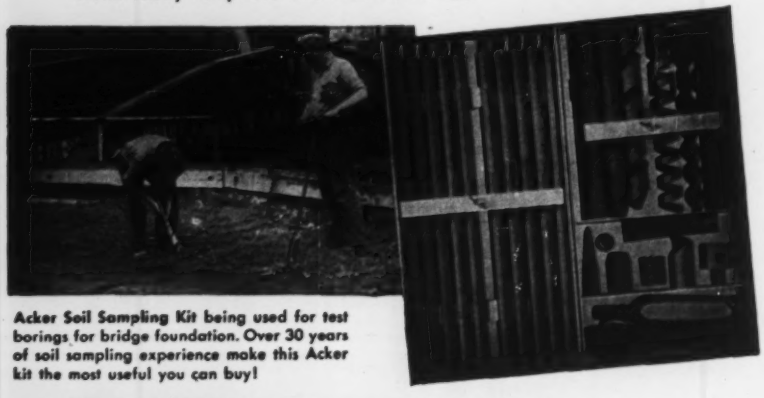
use an ACKER SOIL SAMPLING KIT for accurate sub-surface information

With accurate sub-soil information, you avoid costly trouble later on. And, what better way to get this information than with a portable, easy to use Acker Soil Sampling Kit. For here is a versatile collection of twelve soil sampling tools packed in a handy steel kit that can be carried in any car.

Write today for prices and Bulletin 26. CE



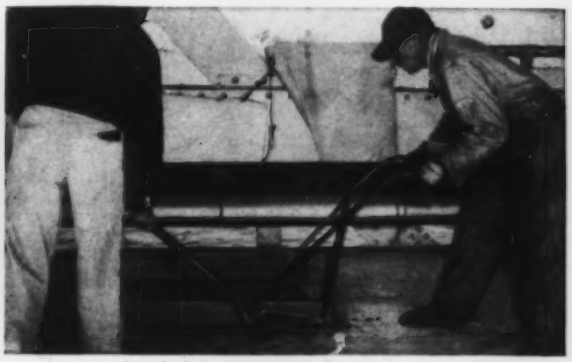
Acker Soil Sampling Kit being used for test borings for bridge foundation. Over 30 years of soil sampling experience make this Acker kit the most useful you can buy!

ACKER DRILL CO., Inc. P.O Box 830 Scranton, Penna.

Concrete adhesives and mortars with **THIOKOL** polysulfide polymer

MAKE LITTLE OF BIG REPAIRS

STRUCTURAL. Polysulfide-modified concrete adhesives join new concrete to old—or rejoin old sound concrete—with a *watertight* bond that's stronger than concrete itself. They have wide use in vertical building. Their application on this fire-damaged marine terminal (gutted concrete sprayed with adhesive then new concrete poured) avoided complete reconstruction, saved the city years of time and millions of dollars in remedial costs.



ROADWAYS. Polysulfide-modified mortars patch potholes and fill ruts and dips. In this application, adhesive and aggregate are mixed in a ratio of 1 to 5, spread and troweled like concrete. Digging down to bedrock or exposing steel reinforcements and pouring new concrete (conventional repair techniques which tie up traffic for days) is avoided. Polysulfide-modified mortar cures fast. Time, labor and the public temper saved.

FLOOR PATCHING. In plants where regular concrete has broken down under exposure to abusive traffic, chemicals or corrosive agents, mortars with THIOKOL polysulfide polymer have stood the test of time and wear.

*Registered trademark of the Thiokol Chemical Corporation for its liquid polymers, rocket propellants, plasticizers and other chemical products.

Thiokol®

CHEMICAL CORPORATION

780 NORTH CLINTON AVENUE • TRENTON 7, NEW JERSEY

In Canada: Naugatuck Chemicals Division, Dominion Rubber Co., Elmira, Ontario

Thiokol Chemical Corporation is the raw material supplier of polysulfide polymer used in the manufacture of concrete adhesives and mortars.

FOR MORE INFORMATION: Mail Coupon to Dept. 2 CA-56
Thiokol Chemical Corp., 780 N. Clinton Ave., Trenton 7, N. J.

Send Thiokol's booklet "Concrete Adhesives for Concrete Construction & Maintenance." Also, a list of manufacturers marketing concrete adhesive systems.

Name_____

Firm_____

Street_____

City_____ Zone____ State_____

Chief interest: ☐ Structural ☐ Roadways ☐ Floor Patching

In the field of

HYDRAULIC DREDGING

GAHAGAN

a leading name for over 50 years

Gahagan Dredging Corporation, 90 Broad Street, New York 4, N. Y. Write, wire, or phone Whitehall 3-2558. Cable "Waigahagan".

New book tells

Where . . .

How . . .

to place reinforcing bars

Written for bar setters and inspectors . . . as a manual for apprentice courses . . . and a reference for specification writers, architects, engineers, and detailers.

Contains complete specifications and instructions for placing reinforcing bars, welded wire fabric, and their supports.

Prepared under the direction of the C.R.S.I. Committee on Engineering Practice.

Concrete Reinforcing Steel Institute

38 South Dearborn Street (Div. N)
Chicago 3, Illinois

CATALOG DIGESTS

107 HOME SEWAGE EJECTOR

Smith & Loveless—A bulletin on the factory-built "Uniject" pneumatic sewage ejector for single dwellings is offered. It is designed to raise sewage to a gravity sewer line, on-the-site treatment facility or septic tank. Capacity to 15 gpm at 20 ft tdh. Not a sump pump, it handles 3-in. solids.

108 HYDRAULIC TURBINES

The James Leffel & Co.—Details on turbines which drive both power generating and pumping units at the United States Bureau of Reclamation's Chandler Power and Pumping Plant are given in 12-page Bulletin 1098-E. Descriptive literature on other recent Leffel turbine installations will be enclosed.

109 HYDROLOGIC INSTRUMENTS AND ACCESSORIES

Leupold & Stevens Instruments, Inc.—A complete short form catalog of Stevens hydrologic instruments and accessories has been published. Included are descriptions and photographs of liquid flow recorders and indicators; liquid level recorders; telemetering systems; servo controls for recorders and transmitters; precipitation recorders and gages; and accessory equipment.

Please give your complete address.

110 IMPROVEMENT OF WATER FACILITIES

Cast Iron Pipe Research Association—By writing on their business letterhead, engineers concerned with water utilities may have a copy of this association's book "Water—Make Sure You'll Always Have Plenty." Prepared to acquaint civic leaders with the seriousness of the community water problem, it gives a step-by-step outline of what citizens can do to help improve community water facilities by working with water utility executives.

111 INSTRUMENTS

Leupold & Stevens Instruments, Inc.—Servo controls, including the Stevens Surface Detector and the Manometer Servo (Bubble Gage), designed to eliminate stilling wells normally required for float operation of recorders, are described in the 7th edition of Bulletin 18. Also described are hydraulic laboratory instruments and accessory equipment for stream gaging including: current meter reels, tag lines, anchor gages, staff gages and the Stevens Midget Current Meter.

112 INTERLOCKING STEEL FRAMING

Macomber, Inc.—Availability of a new 48-page "Macomber V-LOK Design Manual" containing a complete structural analysis of interlocking steel framing has been announced. Included in the manual are details on designing and specifying columns, girders and purlins for offices, industrial and commercial buildings and schools. Also included is a 14-page load table section featuring purlins, girders, columns and steel roof deck.

113 JETTING PUMPS

Griffin Wellpoint Corporation—A booklet illustrates jetting pumps for pile and caisson jetting, oil pipe line testing, water supply and fire protection. The illustrations show unusual set-ups for high-pressure jetting, including parallel and series pumping arrangements.

114 KON-X BEARING PADS

Keasbey & Mattison Co.—A data page is offered describing bearing pads composed of asbestos fibers in combination with a synthetic rubber elastomer. They are ideal as pads under prestressed concrete beams placed over abutments. Resiliency is maintained despite extremes in temperature. The data page details other uses as well as physical parameters.

115 LARGE FASTENERS

Jos. Dyson & Sons, Inc.—An informative 4-page bulletin, No. 160, is offered describing a complete range of large fasteners in bolt diameters 1¾ in. through 12 in. Large fasteners illustrated include a wide variety of standard and special forged nuts in the following types: hexagon, jam, square, slotted, recessed pin nuts and pins, pilots and driving nuts, hexagon and hex socket head cap nuts, coupling and sleeve nuts.

116 LETTERING AND SYMBOLS

Keuffel & Esser Co.—"Leroy Lettering and Symbols," a 36-page catalog, describes Leroy lettering and symbol drawing instruments. The catalog explains the three basic parts: Leroy template, Leroy pen and pencil and Leroy scriber. Pictures and specifications are given of the pen and pencil and scriber. The major part of the catalog pictures in actual size the various templates offered: various size standard lettering, special lettering, and symbols (map, geological, electrical, mathematical, etc.). Also included are descriptions of Leroy sets and accessories.

117 L-E-VATION ROD

Lenker Manufacturing Company—A brochure is offered on the L-E-Vation Rod. This is a new method of reading elevations. The Rod carries the elevation which is read direct. Working from a height of instrument and subtracting rod readings is entirely eliminated.

118 LIGHTWEIGHT PIPE & FITTINGS

Naylor Pipe Co.—Bulletin No. 59 illustrates and describes spiralweld pipe for construction uses, Push-pull ventilation, high and low pressure air and water lines, dredging pipe, etc. in diameters from 4 to 30 in. It includes standard fittings, welded flanges, one-piece Wedgelock couplings, and connections for a pipe line requirements.

119 LOWBED & PLATFORM TRAILERS

Birmingham Manufacturing Company—This catalog lists standard lowbed trailers widely used in transportation of heavy machinery and platform trailers for hauling heavy industrial products; also included are Totem-All trailers for use with pickup truck.

120 MARINE CONSTRUCTION PRODUCTS

Commercial Shearing & Stamping Co.—Marine construction products for harbors, locks, docks, dams and marinas are described in this new 8-page booklet. Included are: channel wales, tie rods and anchor bolts and steel anchor brackets.

121 MARINE CONSTRUCTION PRODUCTS

L. B. Foster Co.—Marine construction products for marinas, harbors, docks and yacht and boat clubs are described in this 8-page catalog. Included are fence posts, structural pipe for pier supports, guard rail, piling for yacht and boat clubs and structural pipe for building columns.

PLEASE PRINT NAME CLEARLY

122 MASONRY TREATMENTS

Standard Dry Wall Products, Inc.—A complete line of products for waterproofing, corrective and protective treatments for masonry is described in this 24-page bulletin. Method of application is thoroughly described in a series of photographs. Applications are pictured and listed. Separate sections give complete details on each product.

123 MEASURING FLUMES

Thompson Pipe & Steel Co.—Parshall measuring flumes, widely used by irrigation companies, farmers, cities and industries, are described in this catalog. All steel construction assures accuracy within 2%. Available in sizes for 0.1 to 1340.0 cu ft per sec. The catalog contains free-flow discharge tables, sizes, capacities and weights.

124 METAL FABRICATION AND CONSTRUCTION

Pittsburgh-Des Moines Steel Co.—A 36-page General Brochure describes the capabilities and diversities of PDM Metal Construction. The facts presented serve as a useful measure of the highly developed knowledge and craftsmanship of the company in engineering, research, fabrication and construction of steel, stainless steel, stainless clad steel, alloy and aluminum.

125 METAL SPECIALTY PRODUCTS

Commercial Shearing & Stamping Co.—A 4-page bulletin featuring a comprehensive list of fabricated, welded and machined metal parts is now available. There is an alphabetical list from anchors to wedges.

126 MISCELLANEOUS DEVICES FOR ALL TYPES OF CONCRETE CONSTRUCTION

Richmond Screw Anchor Co., Inc.—Bulletin No. 11 lists all Richmond building products including new chain clamps and form braces. The complete range of items for prestressed concrete includes: void supports, strand deflectors, lifting inserts, guardrail inserts, diaphragms, road joint devices and a general listing of new products for concrete construction.

127 MOLOX BALL JOINT PIPE

American Cast Iron Pipe Company—Molox Ball Joint Pipe for rivercrossings and other submarine service is the subject of a revised 32-page illustrated catalog. It contains instructions for assembly, weights and dimensions, tables and various installation procedures.

128 "MON-O-JECT" PNEUMATIC EJECTOR LIFT STATION

Smith & Loveless—A color 6-page bulletin on the factory-built "Mon-O-Ject" pneumatic ejector lift station contains features of design, new operational characteristics and advantages of this low-cost ejector lift station.

129 MOTOR GRADER AND VIBRATORY COMPACTOR

The Galion Iron Works & Mfg. Co.—A combination grader and vibratory compactor is described in this bulletin. The compactor delivers 4200 deep-penetrating compacting blows per minute and leaves the surface smooth and flat, with no waves or "washboard" effect. It is easily removed to permit full grader operations.

130 MOTOR INSULATIONS

Fairbanks, Morse & Co.—The selection and application of motor insulations are the subjects contained in this 12-page, illustrated booklet. Included are sections on: how to select insulation systems for specific motor applications; the "combinations and permutations" of selective insulation; a step-by-step procedure; special service environments; and materials of selective insulation.

131 MOTORS, PUMPS AND SCALES

Fairbanks, Morse & Co.—Now you can have a fingertip selector of motors, pumps and scales for industry. Included are fan-cooled, drip-proof, nonventilated and axial air gap motors; centrifugal, end-suction, non-clog, peripheral, propeller, pot, turbine and fire pumps; electronic weight detector, read-out instrument, program control unit, bench, portable and built-in scales, and a desk instrument for visual and recorded weights.

DID YOU MAKE YOUR CHECKS PAYABLE TO THE PROPER COMPANIES? ARE THE AMOUNTS CORRECT?

132 MOVERS

Caterpillar Tractor Co.—The first few feet of material to be moved are often among the most important, especially in such jobs as site preparation, road building and slush pit digging. Equally important is equipment that will move the material quickly and economically. Many important advances in engineering and design incorporated in the new series of Caterpillar-built tractors, motor graders and traxcavators are outlined in this newly released 12-page, 2-color book.

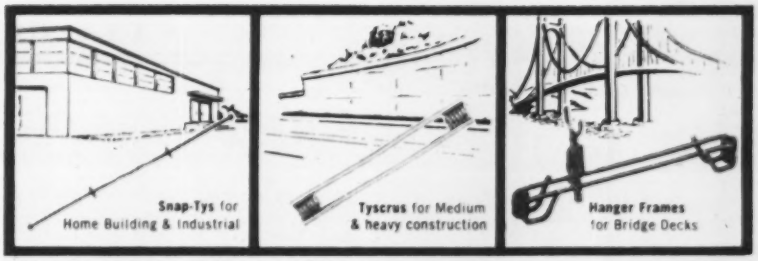
133 MOWER

Mott Corp.—According to this bulletin, the Mott Hammer-Knife® mowing principle makes other mowers obsolete. Described are models especially suited for hillsides, rocks and rubble, thistles, airports, estates, ragweed, cemeteries and parks, roadways and farm yards.

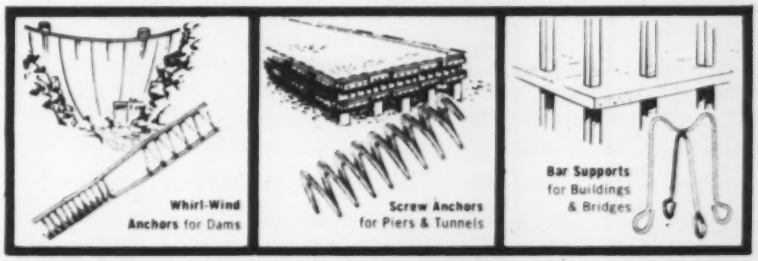
134 NEW WATERSTOP CATALOG

The Gates Rubber Co.—A recently published 24-page catalog, "Gates Kwik-Seal Waterstop," offers a comparison of metal, plastic and rubber waterstop. Basic problems of waterstop construction, testing and handling are discussed. A complete section on design informa-

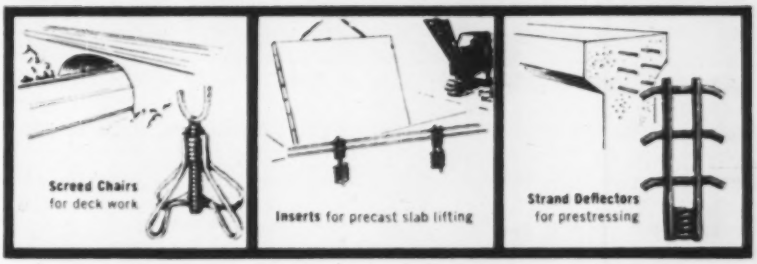
(Continued on page 152)



For every kind of concrete construction



there's a dependable Richmond product!



Richmond has learned, through years of practical experience and research, how to design and produce the most effective and economical form ties, anchors, inserts and accessories for every conceivable kind of concrete construction.

All Richmond-engineered products, and there are more than 400 in the complete line, are designed to provide the extra strength that assures a safe, dependable forming job while saving time and money.

In addition, Richmond's field representatives and Technical Department can help you with any problem you might encounter in planning your form work . . . and will provide you with estimates, "take-offs" and material specifications on request.

Richmond's line of laboratory-tested form ties, anchors, inserts and accessories is the largest—in the field. It provides you with one source for all your concrete forming needs . . . ask for, and insist on "Richmond".

For complete information about Richmond's full line of quality products for concrete constuction—or assistance with any specific concreting problem, write to:—

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SCREW ANCHOR CO., INC.
INSIST ON RICHMOND
AND BE SURE IT'S RICHMOND

Main Office: 816-838 LIBERTY AVENUE, BROOKLYN 8, N. Y.
Plants & Sales Offices: Atlanta, Georgia; Fort Worth, Texas; St. Joseph, Missouri. **In Canada:** ACROW-RICHMOND LTD., Orangeville, Ontario.

For Efficiency and Economy

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LENKER DIRECT READING LEVEL ROD

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Every Rod Reading an Elevation

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No Computations

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Awarded Medal of Merit for Utility by Franklin Institute of Philadelphia

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599 CHESTNUT STREET
SUNBURY, PA.

PHOENIX BRIDGE COMPANY

Engineers
Fabricators
Erectors

Structural Steel
BRIDGES and BUILDINGS

General Office and Shops

PHOENIXVILLE, PA.

CATALOG DIGESTS

tion is included. An application data section covers all forms of splicing, including methods, materials and procedures required. Diagrams and photographs are used throughout the catalog.

135 NON-MELTABLE MASTIC WATERSTOP

Sika Chemical Corp.—A catalog is offered on Igas Joint Sealer, to seal joints and cracks between concrete masonry and steel durably. It is for use in basements, reservoirs, swimming pools, tanks, tunnels and parking decks. It may also be used for flexible watertight membrane coating. The catalog includes joint design details.

136 OILLESS SELF-LUBRICATING BEARINGS

Spadone-Alfa Corp.—This literature describes Metaline Oilless Self Lubricating Bronze Bushings and Wear Plates for industrial and mechanical applications. Exclusive pre-molded lubricant assures dependable service under heavy load, high temperature, submerged and corrosive conditions. They are custom made in a wide variety of bronze alloys to meet the specific duty and application.

137 OPEN FLOORING

Blaw-Knox Co.—Safety, visibility, permanence, and easy maintenance are just a few advantages of open flooring for industrial and public works applications that are described in this 8-page booklet. The literature illustrates the use of open flooring, or electroforged grating, in many industries, including steel, power railroad, paper, chemical, truck and automobile, food petroleum, aircraft, coal, and shipbuilding. In addition, the catalog features grating applications in sidewalks, locks and dams, and sewage treatment plants.

138 OPEN STEEL BRIDGE FLOORING

Kerrigan Iron Works, Inc.—A catalog on Greulich 4-way Grid, 5-in. depth, contains illustrations, full engineering data including properties and load tables. The pamphlet explains the ease of filling half depth with concrete where needed, economical, speedy field erection, and why 20% fewer field welds are needed. Grid fabricated in panels 7-ft 3-in. wide with lengths up to 42-ft.

139 OPTICAL PLUMMET

Warren-Knight Co.—The Warren-Knight Optical Plummet, known as the Tele-Plumb, is exclusive in that it is fastened to the end of the Transit or Transit-Level telescope and the sight to the tack beneath the instrument is made with the full power of the main telescope. The Tele-Plumb pamphlet gives complete information on this optical plummet which saves time in setting up accurately and without the use of a Plumb Bob. The Tele-Plumb is attached permanently and the instrument can be used for regular service without removing the Tele-Plumb.

There are 260 Digest items on pages numbered 138 to 161. Read all items for the literature of interest to you.

140 PACKAGE SEWAGE TREATMENT PLANTS

Walker Process Equipment Inc.—Sparjair units range in capacities from 50 to 5000 pop. equiv. to offer complete treatment plants for housing developments, motels, shopping centers, etc. This package type plant produces a clear, nuisance free effluent through the contact stabilization process. Theory, operation, design factors, specifications and details are covered in bulletin 19-S-94.

141 PAVING HANDBOOK

American Bitumuls & Asphalt Co.—The latest edition of the Bitumuls Paving Handbook covers a wealth of practical data on paving methods and materials. These include road and airport paving specifications and construction details, complete tabular data on asphaltic binder applications and aggregate requirements, with condensed Asphalt Institute specifications. Also, there is data on Laykold compounded asphalts for flooring, tennis courts, and protective coatings.

142 PAYHAULER

International Harvester Company—A 4-page brochure is offered on the Payhauler 19 and 27-ton models. Its features include revolutionary rock-ribbed bodies, 30% less body deadweight; 14% faster haul speeds when horsepower pays off and new 375 and 250-hp diesel engines.

143 PAYSCRAPER

International Harvester Company—A 24-page booklet is offered on the 295 Payscraper. Some of its features include rack-pinion steering system with tandem pumps that deliver equal steering response through the full course of any turn; the 295 gives a new job-proved 375-hp turbocharged diesel; and the payscraper pairs perfectly with any single engine pusher within the 131-in. cut. On the fill it's the tapered bowl, positive ejection 98-in. apron opening and no front bowl cross member that combine to pour out payloads in record time. Also available is a booklet on the 495 Payscraper and 495 Paywagon.

144 PILE DRIVING

C. L. Guild Construction Co., Inc.—A new 16-page brochure includes technical data on load tests, pile shaft loads and Armco Hel-Cor Pile shells. This brochure also includes complete bidding specifications for Cast-in-Place Concrete Piles. Illustrations show completed structures that are founded on Cobi piles and also the illustrated method of driving Cast-in-Place Cobi Piles.

In filling out the coupon, please print clearly and be sure that you furnish a complete address.

145 PILES

The Union Metal Mfg. Co.—Catalog No. 91 on Monotube foundation piles is available. In addition to general descriptive information, the catalog contains engineering data covering physical properties, specification suggestions and test loading; also, contractor data on concrete volumes and weights is included. Advantages listed are: light weight, easy handling, economical field extendability, visual inspection after driving, and highload carrying capacity with extra high economy per ton load supported.

146 PILES

Raymond International Inc.—Standard and step-tapered piles are described in Catalog S-61 which also includes information on the scope of Raymond's activities covering every recognised type of pile foundation. Domestic operations include harbor and waterfront construction, and cement-mortar lining of pipelines in place. Raymond's services abroad also include all types of general construction.

147 PIPE CATALOG

A. M. Byers Co.—The PVC Pipe catalog contains illustrated and detailed sections on installation, joining, specifying, corrosion ratings, dimensional data, properties, principal applications, working pressures, temperatures, impact and head loss in Schedules 40, 80 and 120 in Types I and II.

148 PNEUMATIC SEWAGE EJECTORS

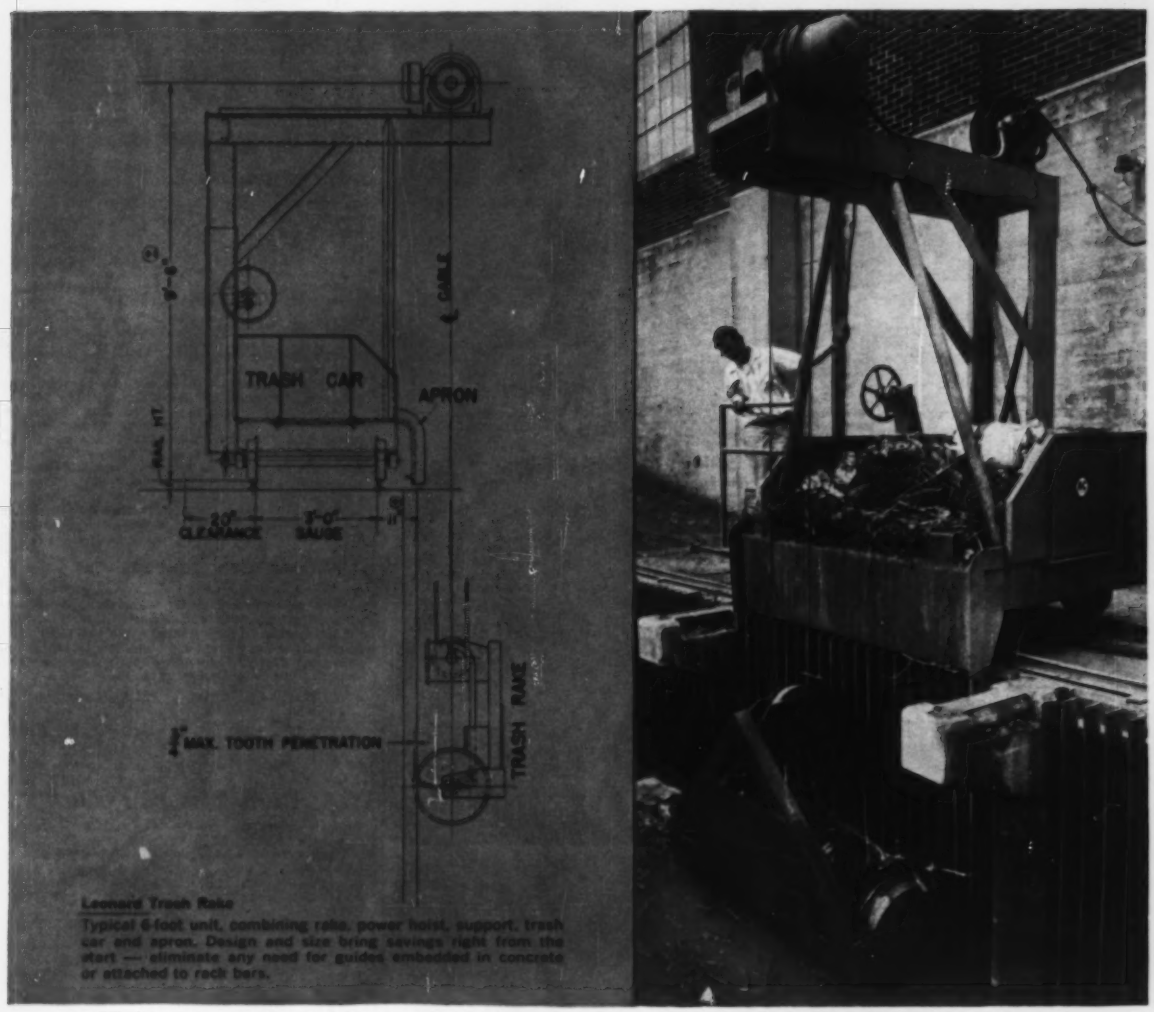
Yeomans Brothers Co.—Units with mechanical control, warranted for 25 years, are described in 16-page catalog No. 4007. Electrode-controlled units are covered in a separate 8-page catalog No. 4305. A 48-page pneumatic ejector manual, No. 4000-03, details the complete line of Shone, Expelsor, and Packex ejectors.

149 PNEUMATIC-TIRE ROLLER

The Galion Iron Works & Mfg. Co.—Bulletin No. 434 gives complete information and specifications on the Galion 12-ton, 9-wheel pneumatic-tire roller. Illustrations clearly explain the exclusive Equamatic front end construction of the roller. This construction is claimed to provide, through the automatic equalizing

(Continued on page 154)

ALLIS-CHALMERS



Leonard Trash Rake
Typical 6-foot unit, combining rake, power hoist, support, trash car and apron. Design and size bring savings right from the start — eliminate any need for guides embedded in concrete or attached to rock bars.

Cleans up costly head losses

. . . rakes-in savings enough to pay for itself!

Here's intake-trash removal so far ahead of hand methods that *"once sold is sold forever!" Leonard* trash rake installations deliver savings both in reduced head loss and labor costs. And they bring a permanent solution to shortages of people to do the job — make trash removal a one-man operation.

***Leonard* trash rakes roll right down your existing rack bars whether vertical or inclined. Because no channel guides are needed, they freely ride over stubborn obstructions, dig them loose, scoop trash up to the waiting receptacle or car. Self-dumping units also are available—both log-grapple and regular models.**

***Leonard* is an Allis-Chalmers trademark.**

With Allis-Chalmers trash rakes even the initial investment is low. Width is held to the logical minimum required for adequate handling of trash . . . standard 6- and 8-foot sizes. Larger units special. Your nearby A-C representative has full details. Or write **Allis-Chalmers,** Hydraulic Division, York, Pa.

A-1307

action of triple king pins, utmost operating stability and balance for the roller when working over uneven and sloping ground.

150 POCKET TRANSIT

William Ainsworth & Sons, Inc.—Information is available on the Brunton Pocket Transit, which is widely used for reconnaissance and preliminary surveying on the surface and underground, for taking topography, and for geological field work. In addition to taking horizontal and vertical angles, it may be used as a prismatic compass, level, clinometer, plumb or alidade. Essentially the transit is a magnetic needle set in an accurately graduated circle in a case which opens into a versatile sighting arrangement. A level is attached to a vernier for reading vertical angles.

151 PORTABLE FIELD AND JOB OFFICE

Porta House—This portable field or job office, used for years by many Western engineering firms, is described in a catalog. The Porta House is made of bolted, waterproof panels, prefabricated from marine plywood, and comes with as many doors and windows as you want. Available from 6 ft by 9 ft up to any size in 3 ft modules, it is quickly assembled or disassembled and easily transported on a pick-up truck. Included are installation illustrations and lists of prices and sizes. Available in Western states only.

152 POZZOLITH, MASTERPLATE AND EMBECO

The Master Builders Company—Two 1960 catalogs, one general and the other industrial, contain performance data and guide specifications for Master Builders products for the improvement of concrete and mortar. Some of the products included in these booklets are: Pozzolith, for the positive control of concrete quality; Masterplate, for longer-lasting concrete floors; Embeco, for non-shrink grout, concrete and mortar; and Omicron Mortarproofing, for control of mortar qualities.

153 PRECAST CONCRETE BRIDGE MEMBERS—AMDEK

American-Marietta Co.—An 8-page folder shows how Amdek prestressed, pretensioned concrete spans revolutionize bridge construction methods. It also illustrates skew beam tests, load distribution tests and tests to destruction being conducted in independent laboratories.

154 PRE-ENGINEERED SECTIONAL BELT CONVEYOR

Stephens-Adamson Mfg. Co.—Bulletin 458 is offered on the new Pre-Engineered Sectional Belt Conveyor. It features comprehensive technical data, pre-engineering advantages and an exploded view of the Sectional Belt Conveyor with all the quality components called-out.

RETURN THE COUPON TODAY FOR IMMEDIATE RESULTS!

155 PREFABRICATED AIRCRAFT STORAGE

United Steel Fabricators, Inc.—This bulletin describes the T-Hangar for aircraft storage. Included is a description of the T-Hangar overhead door, as well as specifications of planes that can be stored in the T-Hanger. The hangar has 30 lb live roof load and 20 lb wind load.

156 PREFABRICATED ASPHALT LINING

Gulf-Seal Corp.—The fourth edition of the Engineering Brochure presents dependable prefabricated asphalt lining. Included are installation details, specifications and photographs of numerous installations. The tough, flexible lining solves many problems involved with the storage of industrial salt water and waste chemicals, municipal treated and untreated water, and in restoring to efficient service steel and concrete reservoirs.

157 PRESSURE FILTERS

Garratt Engineering & Equipment Co.—Readers will find in this illustrated brochure, a table of sizes and capacities for vertical filters, one for sizes and capacities for horizontal filters, and diagrams of the single, duplex and triplex filters. Also included are a general description of "Calfilco" pressure filters, and other pressure filter selection data.

158 PRESTRESSED CONCRETE

Prestressed Concrete Institute—"Inspection of Prestressed Concrete" deals with steel and cement as separate components of prestressed concrete. Included are discussions of the properties of both prestressing steel and portland cement concrete, the placing of the steel, problems of stress, methods of mixing concrete, problems of placing, curing and checking beds and form alignment. The bulletin is available at the cost of $1.00 per copy.

N. B. There is a charge for this publication. Make checks payable to Prestressed Concrete Institute.

159 PRESTRESSED CONCRETE PILES

Raymond International Inc.—Catalog CP-3 describes and illustrates Raymond cylinder piles of prestressed concrete. Information is given on the merits of prestressed concrete piles for foundations of bridges, waterfront and off shore structures. Shown are many examples of installations and suggested designs.

...One man can splice Rubber Waterstop in just 6 minutes

To splice Gates new Kwik-Seal Rubber Waterstop in the field, all you need is a small splicing kit and a simple clamping device. This eliminates the need for a field vulcanizer, molded parts, a power supply or heat.

One man makes this strong, permanent splice in just 6 minutes—5 times faster than with former methods!

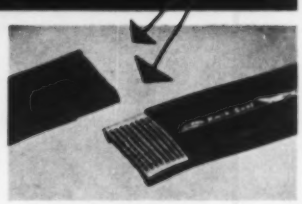
The Gates Kwik-Seal splice is a chemical bond. The strength of the bond often exceeds the strength even of the rubber—far stronger than government requirements. The waterstop can be handled and placed into concrete forms immediately after splicing.

As a result, this new Gates splicing method cuts your labor costs and speeds the job.

WRITE for CATALOG and free splicing demonstration.

The Gates Rubber Co. Sales Division, Inc.
Denver 17, Colorado
Gates Rubber of Canada Ltd.
Brantford, Ontario

SEE OUR CATALOG IN SWEET'S
TPA 978



1 Apply Kwik-Kem bonding chemical to prepared surface.

2 Clamp Waterstop firmly for 5 to 6 minutes... *and it's spliced.*

Gates Kwik-Seal Waterstop

PLEASE PRINT NAME CLEARLY

160 PRESTRESSED CONCRETE TANKS

The Preload Co., Inc.—"Preload Prestressed Concrete Tanks," Bulletin T-22, is a well illustrated, 4-page booklet describing the history of prestressed tanks, design requirements, construction, walls, and floors. Also available is a 4-page brochure, T-23, which is entitled "Prestressed Concrete." This bulletin tells of a 2,000,000 gal elevated water tank in Tyler, Texas.

161 PRESTRESSED CONCRETE TANKS

The Preload Co., Inc.—"The Design of Preload Tanks", Bulletin T-19 is a completely illustrated 8-page booklet describing the design calculations for a prestressed concrete tank. Complete formulas are given for floor, wall, dome and dome ring design.

162 PRESTRESSED PRECAST ELEMENTS

Stressteel Corp.—This technical bulletin describes a factory building 500 ft by 80 ft, built of prestressed precast elements. The feature of the structure framing is a series of three hinged precast arches, the members of which are both prestressed and tied together by post-tensioning with Stressteel Bars. Post-tensioned floor beams tie together the column footings on which the arches rest. The roof consists of prestressed precast double tee slabs. Precast wall slabs complete the structure.

163 PROTECTIVE COATINGS

Koppers Co., Inc.—Bitumastic® protective coatings are specially formulated to prevent corrosion of metal and deterioration of concrete and masonry. This 8-page bulletin covers the different types of Bitumastic. Included is a table of installations and recommended coatings.

164 PRICELESS WATER

Johns-Manville—This 84-page book presents the need for good water service throughout the nation. It demonstrates the need for good facilities; their benefits to the individual, community, business and industry. It offers an

(Continued on page 156)

extensive check list for evaluation of present water utility, and, a step by step outline of what can be done to promote and obtain good water service. Informative and educational, this book is concerned with resources, facilities, personnel and public relations.

165 PROGRAMMING SYSTEM

Bendix Computer, Div. of Bendix Aviation Corp.—A 28-page manual on ALGO, an algebraic compiler for the G-15 digital computer, that enables engineers with no knowledge of computers or programming to solve their engineering problems on the G-15 using the common algebraic terms with which they are familiar.

166 REACTOR-CLARIFIER

The Eimco Corp.—Versatile reactor-clarifier treatment units for obtaining high removals in the pre-treatment or the secondary treatment of sewage with chemical coagulants are described in a new 24-page bulletin. The units are built in a wide range of types and sizes, including units suitable for treating industrial wastes to condition the water for re-use.

167 REFLECTING CONCRETE CURBING

Universal Atlas Cement, Div. of U.S. Steel—A 12-page catalog describes the use of Atlas White portland cement in constructing reflecting curbing and traffic markers for highways, roads and streets. It includes installation details and drawings.

168 REFLECTOR ANTENNAS

Blaw-Knox Company—Reflector antennas, specially designed and fabricated for celestial study, missile and satellite tracking, and radar control, are highlighted in a 12-page booklet, No. 2556. It illustrates equatorially mounted, azimuth elevation, and stationary type antennas, and outlines specifications for some of these units.

Turn to page 138 and order your literature.

169 REFRIGERATED STORAGE FACILITIES

Chicago Bridge & Iron Co.—A new 8-page bulletin describes the ability to build "turnkey" installations for refrigerated storage of liquified petroleum gases. It points up economics, safety and other inherent features of refrigerated storage and includes descriptions and illustrations of storage methods and refrigeration systems.

170 REINFORCED CONCRETE PIPE—HI-HED

American-Marietta Company—A pamphlet containing many photos showing how elliptical Hi-Hed Reinforced Concrete Pipe saves trench width in congested areas and has up to 50% greater strength than its round pipe equivalent. Includes charts on headwall details, physical characteristics and hydraulic properties and discharge graphs. Also folder on elliptical Inner Circles Pipe illustrating quick passage of pipe through pipe underground without disruption of surface traffic.

171 REPRODUCTION ACCESSORIES

Ozalid, Div. of General Aniline & Film Corp.—Tracing and master materials, accessories for preparing originals, drafting equipment and supplies, whiteprint machine accessories and developers and photocopy products are described in this bulletin.

172 REPRODUCTION MACHINES

Ozalid, Div. of General Aniline & Film Corp.—This bulletin describes whiteprinting machines for reproducing drawings, specification sheets, charts, bills of material, etc.

173 RIGID FRAME STRUCTURES

The Prescon Corp.—A new folder describes the use of the company's tendon in post-tensioned prestressed concrete in rigid frame and folded plate roofs. Three examples of folded plates and one rigid frame structure are pictured. The buildings shown are a school, a museum and an airport terminal. Also given are the costs on one job.

174 RING-JET VALVES

Allis-Chalmers Manufacturing Co.—A "Ring-Jet" valve designed for easy regulation and control of water under free discharge is described in this new bulletin. The valve, which is equipped with a hood to minimize the spray and to admit air to the jet, incorporates the

(Continued on page 156)

RECOGNIZED THE WORLD OVER for highest accuracy, convenience, and unequaled precision throughout the instrument. MOST WIDELY USED for first and second order triangulation, and in industry and laboratories where extremely accurate angle measurements are required. Accessories are available for astronomical use.

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WILD T-3
PRECISION THEODOLITE
One of a *complete* line of superb instruments for Surveying, Photogrammetry and Microscopy. *Write for booklet T-3.*

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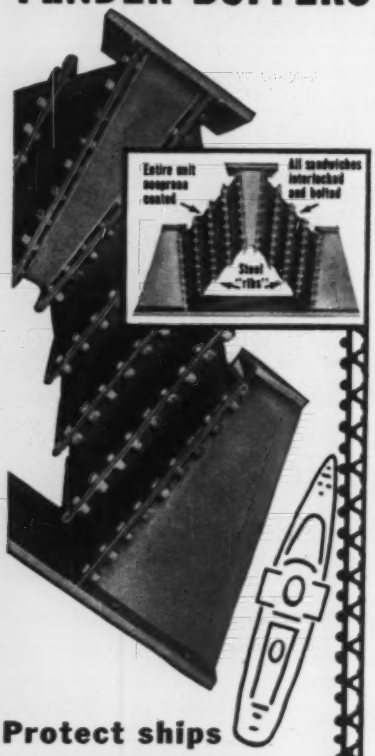
RUGGED RAYKIN FENDER BUFFERS



Protect ships and piers from docking damage

Here's a wonderfully-efficient dock fendering system, easy to install and inexpensive to maintain. Consisting of V-type arrangements of special rubber slabs bonded to tough steel plates, General's Raykin Buffers can be supplied, tailor-made, with deflection from 3" to 24" and energy absorption from 5,000 to 139,000 ft-lbs. Unaffected by corrosion, rotting, or aging, Raykin Buffers give positive, all-angle protection for harbor installations. Send the coupon for more information.

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THE GENERAL TIRE & RUBBER CO.

THE GENERAL TIRE & RUBBER CO.
Industrial Products Division
Wabash, Indiana

Please send information on Raykin Buffers

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Company_____

Address_____

City_____ State_____

CATALOG DIGESTS

simplicity of construction, radially balanced hydraulic design, and easy operation of the Howell-Bunger valve while very nearly matching its high discharge coefficient.

175 ROLLING DOORS

Kinnear Manufacturing Co.—According to this 36-page booklet, these rolling doors meet nine major requirements: "Registered" life extension; quick, easy operation; space saving; greater durability; fire protection; maximum safety; general protection; neat appearance; and economical installation. Steel rolling service doors, steel rolling fire doors, and bifold doors are a few of the rolling doors discussed in the catalog. Also included are specifications, photographs and an index to door types.

176 ROOF BOLT MATS AND SUPPORT LAGGING

Commercial Shearing & Stamping Co.—Roof bolt mats and support lagging for underground mining and rock workings, are presented in this new 4-page bulletin. Also included in the bulletin are some tunnel and shaft support systems.

177 ROOF STRUCTURES

Fluor Products Co.—The roof structures presented in this 24-page booklet include: glued laminated structural lumber, beams, arches, lamella roofs, glued laminated wood purlins and bowstring trusses. The booklet is profusely illustrated with photographs of applications for the different structures.

178 SCREED ATTACHMENT

Blaw-Knox Company—A screed attachment for concrete paving spreaders that eliminates the need for an extra finisher is described in Bulletin SD-125. The literature details one particular job on which the Model 5M attachment was used to increase production considerably, and reduce maintenance and related costs $1,000 per month. The new unit also eliminates tears in concrete and requires only a single screw adjustment for making the crown.

179 SELF-LUBRICATING BEARINGS

Lubrite Div., Merriman Bros., Inc.—Manual No. 56 is a 24 page book filled with complete information, technical data, and specifications about Lubrite self-lubricating bushings, bearings, and washers for industrial equipment, machinery, Hydro-electric, high temperature, missile and atomic applications. Lubrite bearings are completely self-lubricating and do not require periodic maintenance or servicing. Ideal where ordinary lubrication is objectionable, neglected, expensive to maintain or for inaccessible bearings.

180 SELF-LUBRICATING EXPANSION PLATES

Spadone-Alfa Corp.—Literature providing complete information covering Metaline oilless self-lubricating expansion plates and bridge bushings; also, Metaline bearings for underwater installations as found in dam and hydro-electric projects. Metaline products fully meet all federal and state requirements covering this type of material. This exclusive lubricant assures long, dependable service in heavy load, high temperature, submerged and corrosive applications.

181 SEWAGE LIFT STATION

Smith & Loveless—This complete engineering data manual features color bulletins on the sewage pump station and the company's complete line of pneumatic ejector sewage lift stations. The manual includes design drawings, operation characteristics, installation instructions, selection charts and complete data on lift stations.

182 SEWAGE LIFT STATIONS

Yeomans Brothers Co.—"Sewage Lift Stations," the first comprehensive handbook on this subject, contains extensive engineering data on the selection and application of pumping stations for sewerage systems. Describes and discusses centrifugal and pneumatic stations in detail. Bound, the 128-page book is profusely illustrated with photos, drawings, cut-aways, and selection charts. The cost is $4.95 postpaid (student discount allowed).

N.B. There is a charge for this book. Please make checks payable to Yeomans Brothers Company.

183 SEWAGE REGULATORS

Brown & Brown, Inc.—manufacture a line of float controlled quadrant gates, in 37 sizes, to automatically control the diversion of sanitary flows from combined sewers to interceptors. Such automatic gates may be actuated either from head or tailwaters or dually from two sources. Bulletin 81A contains capacity and dimension charts.

184 SEWER CLEANING MACHINES

O'Brien Mfg. Corp.—Several different machines for sewer cleaning are described in this bulletin. Included are Bucket Machines, Power Rodders and Cable Machines. Accessories for different applications are also described.

DID YOU MAKE YOUR CHECKS PAYABLE TO THE PROPER COMPANIES? ARE THE AMOUNTS CORRECT?

185 SHAFT EQUIPMENT

Mayo Tunnel and Mine Equipment—Many kinds of equipment for hoisting material up a shaft are described and illustrated in this 4-page bulletin. Included are the Koepe Hoist System, head frames, sinking frames, cages, skips, kibbles, gilleys and other shaft equipment. Methods, advantages and disadvantages are also discussed.

186 SIDEBOOMS

International Harvester Company—An 8-page booklet has been published on capacity-boosting sidebooms for the 134-hp TD-20 crawler. It contains specifications and illustrations. Also available is literature on the SBI-150 Sideboom.

187 SIMPLE-SPAN BEAM

John A. Roebling's Sons Division The Colorado Fuel & Iron Corp.—Engineering Bulletin PC-946 is entitled "Design Procedure for a Simple-Span Prestressed Concrete Beam." Its contents are based on ACI-ASCE Committee 323 report "Tentative Recommendations for Prestressed Concrete." It is an excellent guide for engineers designing prestressed concrete members.

188 SKID-SHOVEL

International Harvester Company—Two 16-page booklets are offered on the 4-in-1 Skid-Shovel, which is 4 prime construction units—a bulldozer, scraper, skid-shovel and clamshell. Basically, it consists of a super-strong, 2-segment bucket which can be positioned four ways. Each of the four "machine selector" settings forms an efficient, specialized piece of equipment. Change-over from one unit to another takes only a second or two.

189 SLIDE RULES

Keuffel & Esser Co.—The scales, functions and limitations, as well as a description, of standard slide rules are offered in this 24-page catalog. In addition, pictures and specifications of K&E's full line of slide rules in mahogany and plastic are presented, ranging from general purpose to special purpose, Decitrig to Mannheim, standard to pocket sizes. Not an instruction booklet, the catalog serves as a general introduction to the use of slide rules.

190 SLUICE GATE CATALOG

Rodney Hunt Machine Co.—This new, 212-page catalog presents the full line of sluice gates and auxiliary water and sewerage control equipment manufactured by the Rodney Hunt Machine Co. It covers more than 3,000 combinations of types and sizes of sluice gates, as well as hoisting equipment, fabricated gates of metal and wood, valves, regulators, etc. Available to qualified professional engineers involved in the design and specification of sluice gate installations. Please request on your company letterhead.

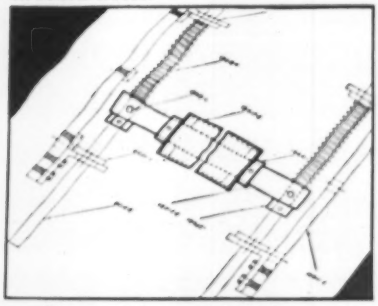
191 SLURRY SEAL

American Bitumuls & Asphalt Co.—"Bitumuls Slurry Seal" is an operation which consists of mixing the aggregates with Bitumuls and water to a slurry consistency in a transit mixer,

(Continued on page 158)

Ever Want Prints Emphasizing Parts of a Drawing?

Engineers, architects and many other types of technical people often want prints that separate key parts of a drawing from the rest of it, and some weird and costly techniques have been used. This is understandable because the cost of *not* getting good separation or emphasis can also be shocking. Take the case of a large West Coast engineering organization constantly involved in plant construction. They used sepia prints of floor plans to lay out the electrical work. But the lack of contrast between the plumbing shown in the sepias and the electrical layouts added required hours of careful checking and frequent revisions, even caused some expensive construction errors.



Diazo print from special-blue image intermediate produces a sharp contrast between the parts to be emphasized and those to be subdued.

That's all ancient history now! Two of Dietzgen's numerous modern drafting-printmaking aids have turned this tough old chore into a picnic. They are new drafting media (one a polyester film and the other a vellum) diazo sensitized to produce a special blue image. The reproduction of your basic drawing on either of these media is bold and clear so drafting additions can be made without confusion or error. But when you make prints from the completed intermediate, the basic part in the special blue prints faintly (clearly visible but subdued) . . . while the added drafting, even in pencil, prints strong and bold. The results are perfect, easily and quickly obtained, delightfully inexpensive.

SOLVED: A COSTLY PROBLEM OF COMBINING DRAWINGS AND GRAPHS

Drafting time costing as much as $40 was used to draw a single grid . . . and draftsmen resented the tedious assignment.

A large manufacturer of automotive parts decided to plot their graphs directly on the drawings in order to end the nuisance of their being separated in handling, filing, plant interchange, etc. But this created many new problems. Tracing or drawing the grids in position proved costly, as much as $40 each in drafting time. They were rarely accurate and never uniform in character. The lines often smudged and usually reproduced poorly. The work created a morale problem because draftsmen resented the tedious assignment.

One of Dietzgen's modern drafting-printmaking aids furnished a perfect answer! It is a light-weight drafting film which is adhesive-backed and furnished printed with a stock grid. It is simply mounted in place and the grids are sharp, clean, clear and uniform, so much more accurate that fewer plotting points are needed to develop the graphs. Reproductions were so noticeably better as prints moved through other departments and associated plants that the change was investigated and quickly adopted. Much needed drafting time and capacity is saved and the reduction in costs amounts to many thousands of dollars a year.

Drafting-Printmaking Handbook reports new techniques for solving engineering and production problems

This new 36 page handbook describes a wide variety of engineering and production problems that have been solved with advance techniques in drafting and printmaking pioneered by Dietzgen. The concise, problem-solution approach suggests ways in which you may improve the efficiency within your engineering department or eliminate production bottlenecks. Write today on your company letterhead for the Mechanics of Modern Miracles. Ask for Publication SPD2-K-81 Eugene Dietzgen Co., Chicago 14, Illinois.

DIETZGEN

EVERYTHING FOR DRAFTING SURVEYING & PRINTMAKING

and spreading over the pavement by a specially constructed squeegee type spreader-box. The action of the squeegee forces the slurry into the fine cracks of a weathered but still sound surface of an old asphalt pavement, thereby reducing expensive maintenance patch construction to a minimum.

192 SNOW PLOW ATTACHMENT

Bros Incorporated—This flyer describes the "Sno-Flyr" rotary snow plow attachment for the Michigan Model 85A and 125A tractor shovel. The "Sno-Flyr" is quickly detachable from the tractor shovel. It handles up to 20 tons of snow per min. and casts up to 75 ft in any direction. The flyer also gives specifications of the snow plow attachment.

193 SOIL COMPACTION

Vibroflotation Foundation Co.—Available is a booklet entitled "Soil Compaction by Vibroflotation" which describes the soil consolidation and engineering services of the Vibroflotation Foundation Co. The booklet illustrates the compaction of 8 to 10-ft cylinders of sandy soil to provide a firm foundation of sand for any type of structure. To make sure of complete coverage in a given area, these cylinders are overlapped according to a predetermined pattern under individual loadings or under entire building areas.

194 SOIL SAMPLING EQUIPMENT

Acker Drill Co., Inc.—The latest soil sampling tools and accessories are described in this new 20-page bulletin with over 50 illustrations. Descriptions of equipment include application and operation.

195 SNOW PLOW ATTACHMENT

Sprague & Henwood, Inc.—The new bulletin 300-1 covers a complete line of soil sampling equipment and the Models PD and PDH Soil Sampling machines. Recent engineering advances include the "wide open" flap valve and the vane shear tester.

196 SOIL TESTING DEVICE

Charles R. Watts Co.—Full information is offered on the Washington Dens-O-Meter, developed by soils engineers of the Department of Highway, State of Washington. Now in use throughout the world for making field density and moisture tests in a wide range of soils, it is accurate and fast in small or large holes up to ½ cu ft—3 ft deep in fine, coarse, granular base and gravels.

197 SOLVING DRAINAGE PROBLEMS

Bethlehem Steel Co., Inc.—Booklet #425-B, entitled "Solving Drainage Problems," is a treatise on the advantages, fabrication, design and installation of galvanized corrugated steel sheets for culverts. It is illustrated with photographs, charts, tables and nomographs, and it contains three sheets of tables evaluating flow friction.

198 SPECIAL PURPOSE INSTRUMENTS

Warren-Knight Co.—Folder SP illustrating and describing the company's special purpose instruments including Sight Clinometers, Precision Vernier Clinometers, Precision 3-arm Protractors, 15-deg Precision Quadrant Levels, 180-deg Variable Setting Clinometers, 110-deg Precision Quadrant Levels, Precise Mounted Levels and Precise Prismatic Reading Levels, is now available. The bulletin also includes information pertaining to mounted and unmounted level vials with illustrations of three frame types, with dimensions, sensitivities and prices.

199 SPECIALTY MACHINES

R. A. Hanson Co., Inc.—Specialty machines for earth excavation and concrete placement are described in this 8-page booklet. Included are canal slip forms, a canal trimmer and trenching machine, jointless monolithic concrete pipe and automatic controls for level, grade and steering. Also, the booklet describes new equipment now in process, a sub-grade trimmer and a highway paver.

200 SPEED REDUCERS

The Earle Gear and Machinery Company—A sixteen-page illustrated catalog, describing speed reducers as applied to operating machinery, particularly bridge machinery, is available. Outlined are specifications, service factors, horsepower ratings and dimensions of the particular units illustrated. Gasoline power units are also dealt with in a compact, easy-to-read form. Photographs are shown of actual installations with miniature blueprints included.

201 SPRAYED-ON FIRE PROTECTION

Keasbey & Mattison Co.—Folder SL-8 gives up-to-the-minute information and technical data on Sprayed "Limpet" Asbestos, including results of its most recent fire tests. Its application to metal beams and columns as well as to cellular steel floors is illustrated and fire ratings listed for each type of use. Sprayed "Limpet" Asbestos now offers protection from flames up to five hours depending upon the thickness of the blanket.

202 STEEL CONSTRUCTION AND FIELD ERECTION SERVICES

Yuba Consolidated Industries, Inc.—The new Bulletin No. YSC 260 offers a description of Steel Construction and Field Erection Services. Yuba crews have experience, imagination and technical proficiency developed through nation-wide experience in erecting and installing Yuba's own manufactured and fabricated equipment, and all types of heavy equipment, for almost every industry. Also described are Bridge Building services.

203 STEEL AND WIRE PRODUCTS

American Steel and Wire Div., United States Steel Corp.—This bulletin describing steel and wire products for use in highways and streets includes: welded wire fabric, transverse road joint load transfer assemblies, multisafety cable highway guard, steel and wire products for reinforced concrete, for reinforced concrete pipe, for tunnel and bridge construction and for bituminous concrete road repairs.

204 STEEL FORMS

Food Machinery & Chemical Corp.—Form-Crete Steel Forms for precasting reinforced or prestressed concrete, are designed to produce the highest quality finished product. This 20-page bulletin describes the many types of Form-Crete Steel Forms, and gives applications and specifications for the different types.

205 STEEL GRANDSTANDS

Pittsburgh-Des Moines Steel Company—A 4-page illustrated folder thoroughly describes construction, design factors, seat spacing, aisle width, specification check points and over-all advantages of these permanent stands for outdoor seating. Formulas for calculating seating capacities are provided, and capacity tables. Types of stands pictured include school, race-track, baseball and fairground structures. Unit construction and adaptability are features of PDM Steel Grandstands.

206 STEEL GRATING AND STAIR TREADS

Kerrigan Iron Works Co.—Because of a new arrangement of standard, close spaced and tread data, this bulletin makes it easier for the reader to find specific types of grating. Included in File No. 14-R are complete tables on safe loads and weight.

Turn to page 138 and order your literature.

207 STEEL PRODUCTS FOR CONSTRUCTION

Inland Steel Company—Complete specifications on construction products are available. Included are wide flange beams, sheet steel pilings, bearing piles, wall armor tees, piling connections, standard structural shapes, steel plates, sub-purlins and 4-Way Safety Plate. The section on high-strength steels covers tensile requirements, chemical composition, bend test requirements, fabricating practice for cold-forming and typical properties of high-strength steels, including High-Strength Structural Steel—Hi-Man 440, which meets the requirements of the new ASTM Specification A-440.

208 STRAIGHT CHORD STEEL JOISTS

Laclede Steel Co.—This catalog covers steel joist construction, Laclede joist standards, steel joist design tables, construction accessories and steel joist specifications. The 52-page catalog is well illustrated with pictures of the various kinds of joists as well as some applications.

209 STRATAGRAPH

Edo Corp.—An illustrated brochure describes the Model 400 Stratagraph, strata penetrating sonar which records, with sharp definition and complete accuracy, formations underlying rivers, lakes and other relatively shallow bodies of water. Sediment, intermediate layers, bed rock and faults are readily distinguished and pictorially shown on permanent chart. The brochure illustrates equipment and typical recordings.

210 STRUCTURAL COMPONENTS

Commercial Shearing & Stamping Co.—Liner plates, roof supports, ring walers, anchor bolts and tie rods, ribs and posts, for above ground and underground construction are described and illustrated in this new 12-page bulletin.

211 SUBGRADER & ATTACHMENT

Blaw-Knox Company—An 8-page bulletin, No. 2652, covering the precision subgrader and a 2-page sheet, No. SD-124, covering the deep cut attachment, are now available. The deep cut attachment is designed for air base work and offers cutting depth range from 12 to 24 in.; it is for installation on GB and GC models. Other features of the subgrader, which excavates through vibration, include: two ranges of excavating widths for single or dual lane paving, fully adjustable strikeoff, quick adjustable crown control, self-powered reverse travel, and fingertip hydraulic depth controls.

212 SUCTION PUMPS

C. H. Wheeler Mfg. Co.—An 8-page catalog describes horizontally split case double suction pumps for medium and high head service.

(Continued on page 159)

BEFORE YOU START THAT WET JOB
Ask How You Can Save
MORETRENCH WELLPOINT SYSTEM
Guarantees Dry Digging
Send for Catalog
MORETRENCH CORPORATION
World's Oldest, Largest and Most Experienced Predrainage Organization
Main Office & Plant: Rockaway, N. J.
Chicago, Ill., Tampa, Fla., Houston, Tex., Hackensack, N. J.

Series arrangements and vertical mountings are illustrated, along with regular mountings. Design and construction details and cross section drawings are included. Capacities range from 50 to 100,000 gpm, heads to 300 ft.

213 SURFACE TREATMENTS

American Bitumuls & Asphalt Co.—"Bitumuls Surface Treatment Manual" is a two-color, 64-page round-up of factual, practical information on all phases of this type of pavement maintenance. Of special note is the attention given to proper evaluation of pavement distress ahead of specifying type of treatment. The manual is heavy on the "how-to" aspects of treatments, from "Black Seal" through "Armorcoats." Other features include a "Glossary of Terms" and a section of useful tables.

214 SURVEY DEPTH RECORDER

Edo Corp.—Literature describes and illustrates new Model 555 Survey Depth Recorder, an improved sonar equipment for charting water depths from 1½ feet to 230 fathoms. New design features assure exceptional accuracy and definition of recordings. The equipment is lightweight, for permanent or temporary installment aboard vessels of every size.

215 SURVEYING INSTRUMENTS

C. L. Berger & Sons, Inc.—A series of descriptive folders illustrating surveying instruments is now available. General characteristics are fully described with essential specifications for each instrument. Also available is a colorful brochure describing the all new plumb bob, the Berger Twin-Point Retracta-Bob.

216 SURVEYING INSTRUMENTS

Charles Bruning Co., Inc.—Precision-built Brunson surveying instruments are described in a colorful catalog available from Charles Bruning Co. The complete line includes high-quality transits, levels and related equipment.

217 SURVEYING INSTRUMENTS

Fennel Instrument Corp. of America—A low priced Optical Plummet Transit and Self-Leveling Level, one second and one minute theodolites, enclosed and standard A and U frame transits, tilting levels, 18-in. levels, convertible transit levels, and builders levels, are covered in a new group of leaflets and a catalog folder.

218 SURVEYING INSTRUMENTS

W. & L. E. Gurley—The complete line of Gurley surveying and engineering instruments, including transits, levels, alidades, are described in the revised edition of Catalog 50. Transits described include the Hell Gate Precise Transit; Standard Precise Transit; Gurley Telescopic Solar Transit; Standard Precise Mining Transit; Optoplane Precise Transit for industrial use; Optical Plummet Transit. Included are cross-sectional drawings of many of the transits. Please write on letterhead.

219 SURVEYING INSTRUMENTS

Kern Instruments, Inc.—A 32-page brochure offers a brief description of the most important instruments manufactured by Kern & Co., Ltd., of Aarau, Switzerland. Fully illustrated, it acts as an index to the detailed literature available on each instrument. Included in the brochure are theodolites, levels, self-reducing tachometers, alidades, pentagonal prisms and many other instruments.

220 TANDEM ROLLER

Essick Mfg. Co.—Information is available on the new Essick 3 ton Tandem Roller model 320, designed and engineered to meet the requirements of faster, more economical compaction with less maintenance, due to lifetime lubricated bearings. Additional safety factors include: greater over-all visibility and flexibility, automotive type steering and a Foot Operated Automotive Type Service and Parking Brake located on the compression roll.

221 TECHNICAL FOUNTAIN PEN

Koh-I-Noor Pencil Co., Inc.—The new Rapidograph Technical fountain pen No. 3065, with 7 interchangeable points is described in this 4-page bulletin. This pen is primarily for the professional man who uses intermittently many different line widths, in his desk and board work, but does not necessarily require either the pocket clip or the automatic filling system. The bulletin also describes the rest of the line of technical fountain pens.

222 TECHNICAL PAPER

Clearprint Paper Co.—Some of the products contained in this booklet are: Clearprint 1000H, a technical paper for drawing and tracing; Papercloth, a technical paper of cloth durability; graph paper; and Fade-Out paper. Price lists and specifications are also included.

223 TECHNICAL PAPERS

Keuffel & Esser Co.—"Graph Sheets, Cross Section & Profile Papers, Cloths, and Films," a newly revised 60-page catalog, consists of two sections: an introductory guide to the selection of grid patterns best suited to individual requirements, and pages selected from the complete K&E Catalog. The reprint pages also describe the various material available: drawing paper, tracing paper, Albanene, tracing cloth, and Herculene and Stabilene films. Applications, specifications and limitations of these various materials are also given.

Please give your complete address.

224 TESTING EQUIPMENT

Soiltest, Inc.—This 316-page catalog contains descriptions and illustrations of equipment for testing soils, concrete, aggregates and bituminous materials. There are also sections on mobile testing laboratories, a road roughness indicator, drilling and sampling and general equipment. There is a handy index in the back, and for your convenience there is a price list and an order blank section.

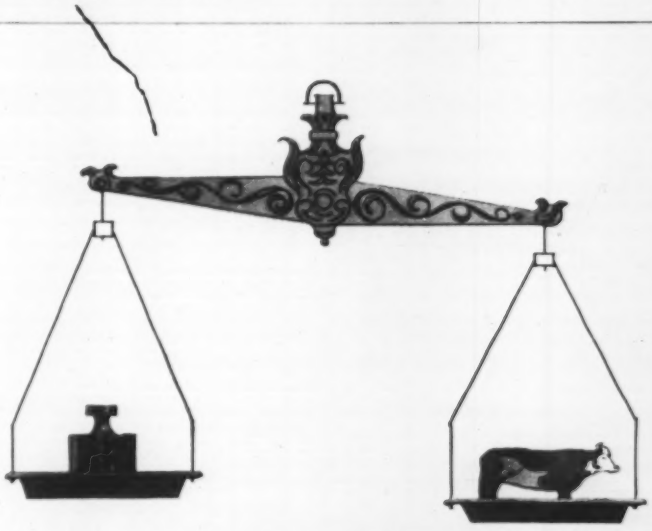
225 THEODOLITES

Keuffel & Esser Co.—Three new theodolites, with seven major features engineered for American practice, are described in the 16-page catalog "Theodolites." Detailed are the KE-2, KE-1 and KE-6c; 1-sec, 20-sec and 1-min theodolites, respectively. Full details are given on the automatic indexing of vertical circle, choice of erected or inverted image, leveling head joint system, control knobs located on one side, simultaneous viewing of both circles, optical plummet built into alidade and fully interchangeable accessories.

226 THICKENING & CLARIFICATION

The Eimco Corp.—The new Clari-Thickener sewage treatment units, in which sludge thick-

(Continued on page 160)



For Value Received

Should price be the sole measure of the value of any product? In almost any business—whether it's "ships, shoes or sealing wax"—you can find some one who will reduce its quality if you require him to reduce its price.

British philosopher John Ruskin once said: "There is hardly anything in the world that someone cannot make a little worse and sell a little cheaper—and the people who consider price alone are this man's lawful prey."

Much credit for the rapid growth of M & H belongs to customer-good-will, customer-confidence, and an extraordinarily healthful customer relationship. Due to a combination of fair dealing, improved product-design, quality materials, delivery schedule-integrity, and honest prices, M & H customers over the years have developed a sense of loyalty to the Company. They simply like to do business with M & H because a basic principle of the Company's sales policy is that the price paid for an M & H product is only one factor of the value the customer receives.

Practical, efficient, dependable field service of M & H products goes on year after year—long after the price is forgotten. No wonder that M & H business volume has grown and grown, and inevitable leadership in the industry has come to the Company and its products.

(No. 5 of a Series)

M&H VALVE
AND FITTINGS COMPANY
ANNISTON ALABAMA
SUBSIDIARY OF WALWORTH

For POSITIVE Sealing of Horizontal and Vertical Joints

Specify and Use

SERVICISED VERTISEAL®

- Maintains positive bond from below 0°F to 150°F
- No cold flow after cure
- Highly resilient—will not work harden
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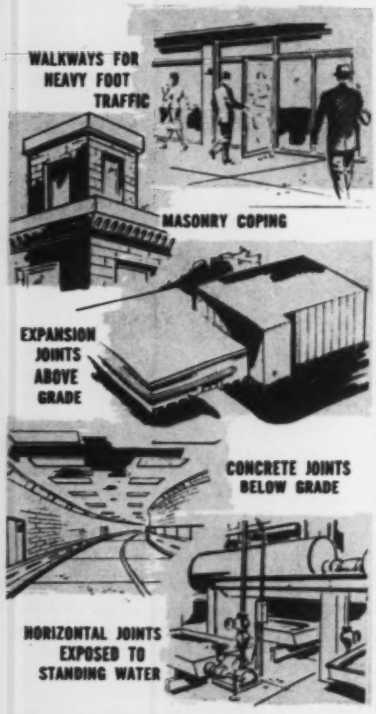
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ening and clarification are combined in a single treatment unit, are described in this new bulletin. Oxidative liquids are used to control septicity in the Clari-Thickener operation. In many sewage treatment operations, Clari-Thickener treatment can eliminate need for separate thickening and clarification units.

227 THREE-WHEEL ROLLER AND VIBRATORY COMPACTOR

The Galion Iron Works & Mfg. Co.—A combination 3-wheel roller and vibratory compactor is described in this bulletin. The compactor delivers 4200 deep-penetrating compacting vibrations per minute, leaving the surface smooth and flat without waves or "washboard" effect. The compactor is easily raised by hydraulic power controlled from the operator's platform, to allow the roller to do all of its regular rolling operations.

228 TIDE GATES

Brown & Brown, Inc.—Literature fully describes a complete line of metal tidal gates in 22 circular sizes and 47 rectangular sizes. Also described are timber gates to meet any requirements and a line of cushioned flap gates for use on pump discharge lines. Dimensional and loss of head data are given.

229 TRACTORS

Caterpillar Tractor Co.—How the power shift transmission, lifetime lubricated rollers and other advanced features of the two largest tractors in the Caterpillar line boost production and save time and money for their owners is told in this recently released 8-page, 2-color booklet. Titled, "The Men Who Know," the booklet takes you on the job to learn from the owners and operators their reasons for choosing the Caterpillar D8 and D9 tractors.

230 TRAFFIC SIGNS

Municipal Street Sign Co., Inc.—Traffic signs for streets and highways are described in this bulletin. Included are signs for Parking Prohibition, Parking Restriction, Regulation, School Signs, Stop and Yield, Warning Signs and Symbols. In addition the bulletin describes sign accessories and a line of sign blanks in all designs, shapes, sizes and thicknesses.

231 TRANSITS AND DUMPY LEVELS

Texas-Asiatic Import Co.—This literature describes the Eagle 6-in. Standard Transits (20-sec and 1-min horizontal verniers), which are made of solid bronze, with a unique 11-piece optical system and several refinements not found on any other instrument. It also describes the Eagle Engineer's Dumpy Levels, which are available in both an 18-in. and 15-in. model.

232 TRI-ACETATE SHEETS

Stanpat Company—Circular describing their printed adhesive-backed acetate sheets for speeding up drafting is available. These sheets are attached to original drawings and save draftsmen from redrawing standard details and repetitive notes. Resulting prints are clear and sharp and save tremendous amounts of time.

233 TRUE MERIDIAN IN DEFENSE PLANT

Kern Instruments Inc.—Civil Engineers reprint describes the use of a Kern Theodolite to solve the difficult problem of establishing a true meridian inside of a defense plant for testing of weapons components.

234 TURBINE PUMPS

Fairbanks, Morse & Co.—Water lubricated turbine pumps are covered in this new bulletin. The standard construction of the Pomona Turbine Pump is illustrated with descriptions of the various parts. Also, there are illustrations of the various types of heads and drives offered with the Pomona pump, and a selection of pumps for every pumping purpose.

235 TYLOX "C" SERIES GASKETS

Hamilton Kent Mfg. Co.—A 4-page brochure in color fully describes and illustrates Tylox "C" and "C-P" sewer pipe gaskets now being made available to engineers and contractors. "C" and "C-P" and "snap-on" gaskets designed for concrete pipe of all sizes, with single or double offset, and provide true compression, leak-proof joints capable of withstanding pressures up to 50 ft. They are furnished in either rubber or neoprene, and may be installed on the pipe either at the pipe manufacturer's plant, or by contractors at the job site.

236 TYLOX "C-R" GASKETS

Hamilton Kent Mfg. Co.—A 4-page brochure in color fully describes and illustrates the use of Tylox "C-R", a new rubber gasket for recessed sewer pipe which cannot roll or twist out of position during pipe coupling operations. The gaskets are of the "snap-on" type for recessed concrete pipe of all sizes, and of either bell and spigot or tongue and groove types. They may be made of rubber or neoprene, and form a leak-proof, acid-resistant seal when pipe is coupled.

237 UNDERDRAIN PIPE

Johns-Manville—This folder describes advantages of Johns-Manville perforated Transite® asbestos-cement underdrain pipe for airports, highways and other large areas where drainage is a problem. The pipe is designed for subgrade stabilization of soil by maximum control and removal of subsurface water. The physical and chemical qualities of asbestos and cement include: strength, toughness, light weight and resistance to internal corrosion and most chemical action.

238 UNDERGROUND IRRIGATION MAINS

Johns-Manville—Transite® underground irrigation mains for turf, landscaped areas and farm installations are described in booklets offered by Johns-Manville. Light weight, long lengths and Ring-Tite® joints result in economical assembly. Smooth pipe interior insures high water carrying capacity, reduces pumping costs, saves water. The pipe is non-metallic, can't rust and resists corrosion inside and out.

239 UNDERGROUND RAIL MOUNTED LOADER

The Eimco Corp.—This bulletin carries specifications and lists new working features of this new underground rail-mounted loader, successor to the 21 Rocker Shovel, which has a larger bucket, new cast steel arms, greater digging force and depth and many other improvements.

240 UNDERPINNING

Spencer, White & Prentis, Inc.—"Underpinning," a book by Edmund Astley Prentis and Lazarus White is recognized as the authoritative source for information in the field by engineers, architects and contractors all over the world. The price is $10.

N. B. There is a charge for this book. Make checks payable to Spencer, White & Prentis, Inc.

241 "VAC-O-JECT" PNEUMATIC SEWAGE EJECTOR

Smith & Loveless—A bulletin on the factory-built installation in a wet well or receiving manhole is offered. The brochure describes design features, operational characteristics and advantages of this low-cost ejector station available in simplex and duplex units.

242 VALVES

Allis-Chalmers Mfg. Co., Hydraulic Div.—Howell-Bunger valves for power, flood control, irrigation, drainage, turbine bypass, and aeration of water are described in Bulletin 02B9206. The valves have a wide range of application where easy, efficient regulation and control of water flow under free discharge is demanded.

Please allow at least four weeks to process your requests.

243 VAPOR SEAL

W. R. Meadows, Inc.—This booklet fully explains in a direct and easy to understand manner, the cause and effect of destructive moisture, the need for a true vapor seal and how "Premoulded Membrane" meets this need. The booklet covers architectural and engineering data, technical information, various applications and specifications.

244 VIBRATION AND SHOCK ISOLATORS

Voss Engineering, Inc.—Comprehensive technical manual will assist engineers in solving vibration and shock problems with Sorbtex

(Continued on page 161)

preformed fabric neoprene and rubber pad materials. New concepts in the use of Sorbtex are presented for the first time.

245 VOLATILE LIQUID PUMPS

Layne & Bowler, Inc.—This new, 3-color, 6-page bulletin concerning volatile liquid pumps, includes cross-section drawings of the standard short coupled vertical turbine pump and the canned type vertical turbine pump with uses and applications illustrated.

246 WATER SEAL UNITS

Pacific Pumping Co.—Water Seal units, used for maintaining clean water supplied under pressure to the packing glands of sewage, dredge, or other pumps handling liquids containing dirt or abrasives, or to the water cooling jackets of hot liquid pumps, are described in this bulletin. The units are complete with receivers of various sizes and with pumps of either the centrifugal or regenerative turbine types.

247 WATERSTOP MANUAL

W. R. Meadows, Inc.—The availability of a manual on "Sealtight" PVC Waterstops has been announced. It describes applications, installation information, product specifications and engineering data, and gives complete range of product sizes and types.

248 WATER, WASTE & SEWAGE TREATMENT EQUIPMENT

Walker Process Equipment Inc.—A 24-page, two-color bulletin, No. G50, describes and illustrates the major items of equipment offered by this firm for municipal and industrial water and waste treatment. It also includes description of the Company's facilities for equipment engineer, laboratory and manufacturing activities.

249 WATER WELL CASING

Thompson Pipe & Steel Co.—Well casing made of mild or stainless steels is made with a choice of 5 perforations to suit all soil and corrosion conditions. In this catalog, many accessories and field joints are described as well as the well casings.

250 WATTS MICROPTIC THEODOLITE

Eugene Dietzgen Co.—A 6-page folder illustrates and describes both the distinguishing features and specifications of the Watts Microptic Theodolite #1 and #2. Information on the new Autoset Level, the Microptic Engineer's Level and the Precise Level is also included.

251 WATTS AUTOSET LEVEL

Eugene Dietzgen Co.—A 5-page two-color folder that completely describes and illustrates the new automatic level called the Watts Autoset Level is available. Four diagrams describe the difference in operation between a conventional level and the new Autoset Level.

252 WELDED STEEL GRATING

Rockwell-Standard Corporation, Grating Div.—A 6-page booklet is offered on Gary Welded Steel Grating with the hexagonal cross bars. Engineering data and illustrations of different applications are also included.

Turn to page 138 and order your literature.

253 WELLPOINT DEWATERING

Griffin Wellpoint Corp.—"The Griffin Wellpoint System", a 32-page digest showing a wide variety of wet jobs, many of which present unusual dewatering problems, is now available.

254 WELLPOINTS

Moretrench Corporation—A 4-page bulletin illustrating and describing standard and special types of Moretrench Wellpoints and their use in various types of jobs has been made available.

255 WELLPOINT SYSTEM

Moretrench Corp.—Pictured in this new 64-page catalog are various types of dewatered projects. The catalog gives factual descriptions of pumping problems successfully handled by this company's wellpoint equipment. There is also a list of brochures available for detailed information on key parts of pumping equipment.

256 WHITEPRINT MATERIALS

Ozalid, Div. of General Aniline & Film Corp.—This bulletin describes dry diazo-sensitized whiteprint materials: opaque papers, translucent papers, cloths, acetate films, polyester films.

257 WHITEPRINT MATERIALS

Ozalid, Div. of General Aniline & Film Corp.—Semi-dry diazo sensitized materials are described in this catalog and price list. Included are developing opaque and translucent papers.

258 WOOD & STEEL TYPE DOORS

The Kinnear Mfg. Co.—The catalog and data book discusses fully and illustrates the advantages, the economy, the construction features and the general specifications of the various types of wood and steel upward-acting type doors. Known as Bulletin 101 it gives information on installation, clearance requirements, methods of operation and controls, as well as adaptability of the doors for many types of uses.

259 WROUGHT IRON PIPE

A. M. Byers Co.—Eight pages spell out wrought iron's corrosion resistance, ease of fabrication, strength, elasticity, weight, and its ability to form its own protective coating. A number of case histories in various services are discussed.

260 YEAR ROUND CONCRETING

Calcium Chloride Institute—An 8-page pamphlet entitled "Year Round Concreting" is available to concrete users; it summarizes the new American Concrete Institute's standard recommendations for cold weather concreting. Included are sections on accelerators, preparation before concreting, winter concreting objectives, and production required. A 2-page chart illustrates data on the effect of 2% calcium chloride at temperatures of 73, 55, 40 and 25 F, on Type 1 and Type 3 cement. Guide specifications, prepared by the CCI, are included for architects and consulting engineers.

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PROCEEDINGS AVAILABLE

September

Journals: Highways, Irrigation and Drainage, Sanitary Engineering, Structural, Waterways and Harbors.

2588. Development of Rotational Irrigation in Taiwan, by Lee Chow. (IR) Rotational irrigation, now rapidly replacing the old irrigation practice in Taiwan, is described with special emphasis on design and operation of such irrigation systems: Future improvements to be made and possible research to be done are also pointed out.

2589. Geophysical Procedures in Ground Water Study, by H. R. McDonald and Dart Wantland. (IR) Although geophysical methods of subsurface exploration were developed primarily for, and have been used most extensively by, the petroleum industry, many of the procedures apply equally well in the search for ground water. The principles of the geophysical methods most useful in ground water exploration are described and illustrated.

2590. Tetrapods and other Precast Blocks for Breakwaters, by P. Danel, E. Chapus, and R. Dhaille. (WW) Other shapes have been proposed for precast blocks for breakwaters since tetrapods were first introduced about 10 yr ago. The authors briefly consider the problems arising in the design, manufacture, and placing of such blocks. Consideration is then given to the problem of utilizing precast blocks on breakwaters. Attention is drawn to the great number of factors that have to be taken into account when designing a breakwater.

2591. Installation of Drain Tile for Subsurface Drainage, by John G. Sutton. (IR) This paper reports current progress in installation of tile drains for subsurface drainage. It also describes benefits of tile drainage, discusses tile used in combination with surface drainage, and describes current procedures used by the Soil Conservation Service in making drainage investigations. Recommendations are given for use of concrete tile under acid and alkali conditions.

2592. High Temperature Effects on Bituminous Mixes, by William H. Gotolski. (HW) Temperature effects on the stability characteristics of bituminous mixtures were studied for four asphalt and aggregate temperatures. This study was made to ascertain the temperature at which detrimental characteristics are exhibited. Analysis of variance techniques were used to evaluate the basic factors affecting the test results.

2593. Irrigation and Drainage Potentials in Humid Areas, by Marion Clifford Boyer. (IR) In the words of the demographers, the world's population is "exploding." It is estimated that by the year 2,000, the United States will be producing approximately one-third more food than needed for its own people, while Communist China and much of the rest of the world will be producing less than one-half the food needed. Civil engineers must accept the responsibility for making the cultivated lands yield most efficiently through proper irrigation and drainage, particularly in the humid areas of the world.

2594. Drawdown due to Pumping from an Unconfined Aquifer, by Robert E. Glover and Morton W. Bittinger. (IR) Based upon the Dupuit-Forschheimer idealization, a first approximation to the drawdown y at the radius r in an unconfined aquifer of permeability K, saturated depth D, and drainable voids V due to pumping at a constant rate Q for the time t is obtained. A second approximation accounting for the effect of drawdown is found. The flow conditions are specified by a parameter.

2595. Methods of Applying Irrigation Water, by Paul H. Berg. (IR) The factors influencing the selection of a method of applying irrigation water on a farm are described in general. The various methods of irrigation and a brief examination of the conveyance and distribution systems used for providing irrigation water on an individual farm are presented.

2596. Freeway Spacing in an Urban Freeway System, by James M. Peterson. (HW) The various controls that influence freeway spacing in an urban freeway system are described and categorized. A simplified study procedure is outlined that illustrates the interrelationships of certain variables affecting freeway spacing in a grid system.

2597. Arkansas River Plan, by William Whipple, Jr. (WW) Development of the Arkansas River for navigation and other purposes poses especially difficult problems on account of the quantity of sediment carried. A revised concept and plan based on relationships between slopes, depths, and widths of contracted channels results in the elimination of three dams and savings of $31,000,000.

2598. Computer Application in Groundwater Hydrology, by Joseph Foley. (IR) The Theis equation is adapted for computer solution of four

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types of problems inherent in many industrial well-water developments: (1) Drawdown calculations; (2) Aquifer constants "T" and "S"; (3) Well spacing; and (4) Capacity of a well system. Objectives, equations, computation sequence, print-out of results, and computer time are outlined for each prob'em.

2599. Shark River Inlet Sand By-Passing Project, by W. Mack Angas. (WW) This paper describes the by-passing of sand across an Atlantic Coast bay inlet in a successful effort to correct an unwanted accretion and erosion problem resulting from littoral drift. This is one of the first major by-passing projects to be accomplished by mechanical rather than by hydraulic methods.

2600. Pneumatic Barrier Against Salt Water Intrusion, by Ian Larsen. (WW) In rivers subject to salt water intrusion, bubbles of air from perforated pipes on the river bottom will create an upward flow of salt water and thus, a mixing between the fresh and salt water layers. When the upward flow reaches the absolute maximum of salt water discharge, the salt water will be unable to penetrate the bubble "curtain." Such installations may provide the answer to the salt water problem in many rivers.

2601. Studies of a Channel through Padre Island, Texas, by E. A. Hansen. (WW) The problems of tidal hydraulics encountered in design of an artificial inlet from a gulf to an almost tideless bay are numerous. This paper presents the results of several years' observation of tide and current phenomena in such an inlet, and the studies made to determine the best design for a jettied navigation channel through the inlet.

2602. Plan for Closure of Old River, by George M. Cookson. (WW) The closure of Old River is the crucial feature of the project for flood control and improvement of the lower Mississippi River. This operation involves an initial rock closure, followed by a final hydraulic fill. Geological features and hydraulic characteristics require this procedure in order to provide maximum assurance of positive closure within economical limitations.

2603. Design of Inlets for Texas Coastal Fisheries, by H. P. Carothers and Homer C. Innis. (WW) The basic formulations for dynamic balance in design of Texas coastal inlets to permit fish passage through the littoral barriers and induce Gulf water interchange for control of bay salinities are presented. Rollover and Yarborough passes illustrate extremes of erosion and siltation. Cedar Bayou illustrates elastic limit design toward siltation.

2604. Traffic Behavior and Freeway Ramp Design, by Charles Pinnell and Charles J. Keese. (HW) Highway designers must become more concerned with the relationship of design and traffic behavior in order to obtain maximum operational efficiency on freeway facilities. This paper points out the operational characteristics of freeway ramp traffic and presents requirements for correlating ramp design with traffic behavior.

2605. Use of Algae in Removing Phosphorus from Sewage, by R. H. Bogan, O. E. Albertson, and J. C. Pluntze. (SA) The concept of employing algae as a means of removing phosphorus from domestic sewage was investigated in the laboratory. Work leading to development of a tertiary stage photosynthetic treatment process is described. Laboratory and field scale pilot plant studies are reported on.

2606. Southwest Pass—Mississippi River 40-ft Channel, by Austin B. Smith. (WW) The paper examines shoaling triggered by a saltwater wedge, maintenance and channel improvements for the 35-ft ship channel, field data obtained, saltwater intrusion phenomena, shoaling rates, and prototype studies. Conclusions are based on empirical findings and model tests.

2607. Low Pressure Aeration of Water and Sewage, by N. Claes H. Fischerstrom. (SA) Based on simplified theoretical considerations, a calculable system utilizing dispersed air at shallow depths has been developed. Elaborate tests and full scale operations have proved that it is possible to obtain an extremely high oxygenation capacity with this principle, and with perforated pipes as air distributors. Clogging of the pipes has been studied and satisfactorily eliminated.

2608. Tests on a 120-ft-Span Prestressed Concrete Beam, by G. D. Base and R. E. Rowe. (ST) Tests to destruction have been carried out on a 120-ft-span prestressed concrete beam similar to the beams to be used in the construction of a 4-span overpass at the Chiswick rotary junction. The tests showed that the design assumptions with regard to the loss of stress due to friction and short-term creep, shrinkage, and relaxation were valid. The behavior of the beam in the working-load range agreed excellently with the behavior predicted.

2609. Discussion of Proceedings Paper 2089, 2343, 2408, 2411, 2424. (SA) Norman B. Hume, Robert D. Bargman, Charles G. Gunnerson, and Charles E. Imel on 2089. John A. Logan on 2343. M. B. McPherson on 2408. F. Sulzer and C. E. Keefer on 2411. J. M. Jordan, Jr. and C. H. Lawrance on 2424.

2610. Irrigation in Latin America, by Lyman S. Willardson. (IR) Irrigation agriculture in three representative Latin American countries needs competent technological guidance to utilize the potential of unusual tropical conditions. Non-uniform annual distribution of rainfall combined with ideal soil and twelve-month growing season favor high agricultural development in these representative Latin American countries through supplemental irrigation, coupled with coexistent drainage of excess rainfall during wet seasons.

2611. Discussion of Proceedings Paper 2171, 2422, 2423. (WW) Thorndike Saville, Jr. and Robert Y. Hudson on 2171. F. F. Escoffier on 2422. J. W. Dunham, Per Bruun, and J. M. Jordan, Jr. on 2423.

2612. Discussion of Proceedings Paper 2410, 2428, 2496. (ST) Merlin D. Copen on 2410. William A. Boe on 2428. W. Jurkovich on 2496.

2613. Discussion of Proceedings Paper 2154. (IR) A. R. Robinson on 2154.

2614. Discussion of Proceedings Paper 2275. (HW) Henry A. Barnes, John Rannells, Charles M. Noble, Hawley S. Simpson, Virdin A. Rittgers, and Seymour Kashin on 2275.

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Throgs Neck Bridge - Owner: Triborough Bridge and Tunnel Authority; Consultants: Ammann & Whitney, Emil H. Praeger, E. Lionel Pavlo; Contractors for Substructure: Merritt, Chapman & Scott Corp., Steers-Snare Joint Venture, Fehlhaber Corp.; Contractor for Paving: Horn Construction Co. and Queens Structures Corp. **Verrazano-Narrows Bridge** - Owner: Triborough Bridge and Tunnel Authority; Consultants: Ammann & Whitney, Emil H. Praeger; Contractor for Tower Piers: Steers-Snare Joint Venture.

PLASTIMENT reduces shrinkage, controls rate of heat development

Throgs Neck Bridge, illustrated above, and the Verrazano-Narrows Bridge, the two largest suspension bridges now under construction in the United States, stand on Plastiment concrete substructures. The nearly completed Throgs Neck Bridge spans 1,800 ft. between towers and stretches 2,910 ft. between anchorages on Long Island and the Bronx. The Verrazano-Narrows Bridge, connecting Staten Island and Brooklyn, will ultimately span 4,260 ft. between towers to become the longest suspension bridge in the world.

Plastiment Retarding Densifier reduced the rate of internal heat development in massive sections of the critical substructures and reduced shrinkage. The use of Plastiment in the tremie concrete improved flow characteristics and minimized the development of laitance. Rapid strength gain was a bonus to the contractor.

Plastiment features are detailed in Bulletin PCD-59. Ask for your copy. District office and dealers in principle cities; affiliate manufacturing companies around the world. In Canada, Sika Chemical of Canada, Ltd.; in Latin America, Sika Panama, S.A.

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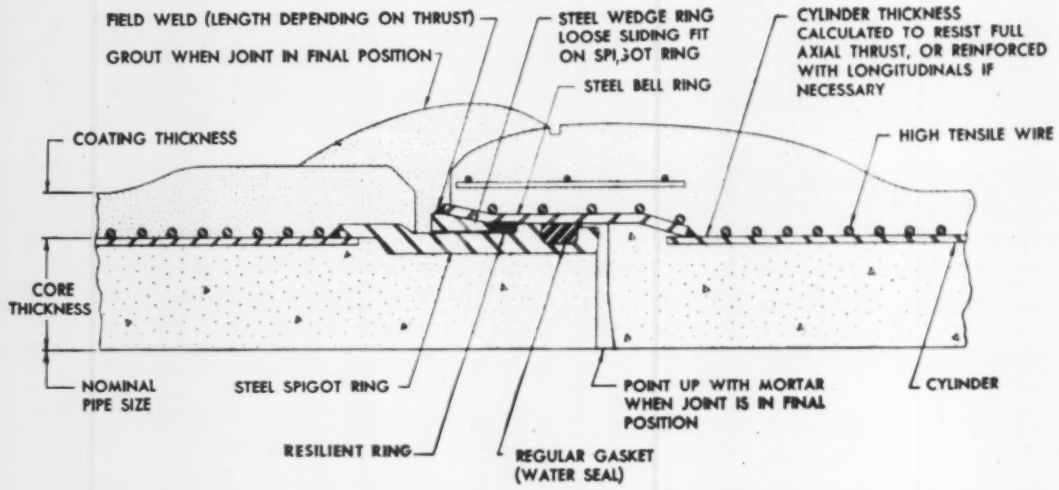
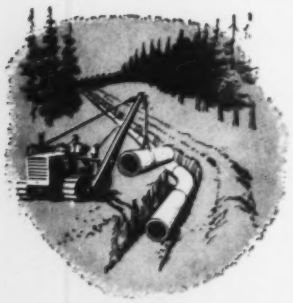
LOCK JOINT'S FLEXIBLE TIED JOINT *


FIELD WELD (LENGTH DEPENDING ON THRUST)
GROUT WHEN JOINT IN FINAL POSITION
STEEL WEDGE RING LOOSE SLIDING FIT ON SPIGOT RING
STEEL BELL RING
CYLINDER THICKNESS CALCULATED TO RESIST FULL AXIAL THRUST, OR REINFORCED WITH LONGITUDINALS IF NECESSARY
COATING THICKNESS
HIGH TENSILE WIRE
CORE THICKNESS
NOMINAL PIPE SIZE
STEEL SPIGOT RING
POINT UP WITH MORTAR WHEN JOINT IS IN FINAL POSITION
CYLINDER
RESILIENT RING
REGULAR GASKET (WATER SEAL)

RUBBER & STEEL FLEXIBLE TIED JOINT

SECURE...FLEXIBLE...WATERTIGHT



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A greater measure of flexibility is imparted to this field-welded joint by the resilient ring, located between the weld and the watertight rubber gasket seal. This ring also improves the tensile characteristics of the joint by distributing the load more evenly around the periphery of the joint ring.

Detailed description of this joint may be obtained from Lock Joint Pipe Company on request.

**Patent applied for.*

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